

SERVICE MANUAL

MODEL : 19LED-4096/T2C; 22LED-6094/FT2C; 22LED-4096/FT2C;
22LED-4097/FT2C; 24LEM-5093/FT2C; 24LED-6094/FT2C;
24LEM-5095/FT2C; 24LED-4096/FT2C; 24LED-4097/FT2C;

(SOLUTION MSD308C)

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This manual is the latest at the time of printing, and does not include the modification which may be made after the printing, by the constant improvement of product.

IMPORTANT SAFETY INSTRUCTIONS



This symbol indicates " dangerous voltage " inside the product that presents a risk of electric shock or personal injury.



This symbol indicates important instructions accompanying the product.

Please read this manual carefully before using this product.

- Before connecting the AC power cord ,make sure the voltage designation of the LCD TV corresponds to the local electrical supply .
If you are unsure of your power supply , ask your local power company .
- Never insert anything metallic into the cabinet openings of the liquid crystal display LCD TV/monitor; otherwise it may create the danger of electric shock.
- To avoid electric shock, Never touch the inside of the LCD TV/monitor .
Only a qualified technician should open the case of the LCD TV/monitor.
- Never use your LCD TV/monitor if the power cord has been damaged .
Do not allow anything to rest on the power cord, and keep the cord away from place where people can trip over it .
- Be sure to hold the plug, not the cord, when disconnecting the power cord from an electric socket.
- Openings in the LCD TV/monitor cabinet are provided for ventilation.
To prevent overheating, these openings should not be blocked or covered. Also, avoid using the LCD TV/monitor on a bed ,sofa ,rug, or other soft surface. Doing so may block the ventilation openings in the bottom of the cabinet. If you put the LCD TV/monitor in a bookcase or some other enclosed space, be sure to provide adequate ventilation.
- Do not expose the LCD TV/monitor to extreme temperature conditions or to extreme humidity conditions.
- The apparatus shall not be exposed to dripping or splashing and that no objects filled with liquids.

PRODUCT SPECIFICATION

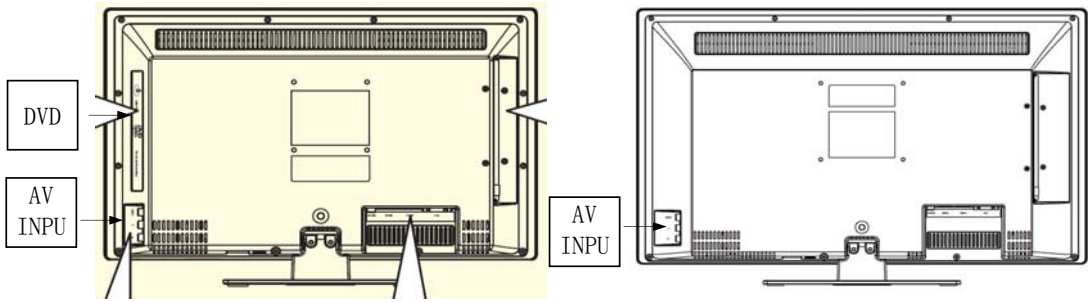
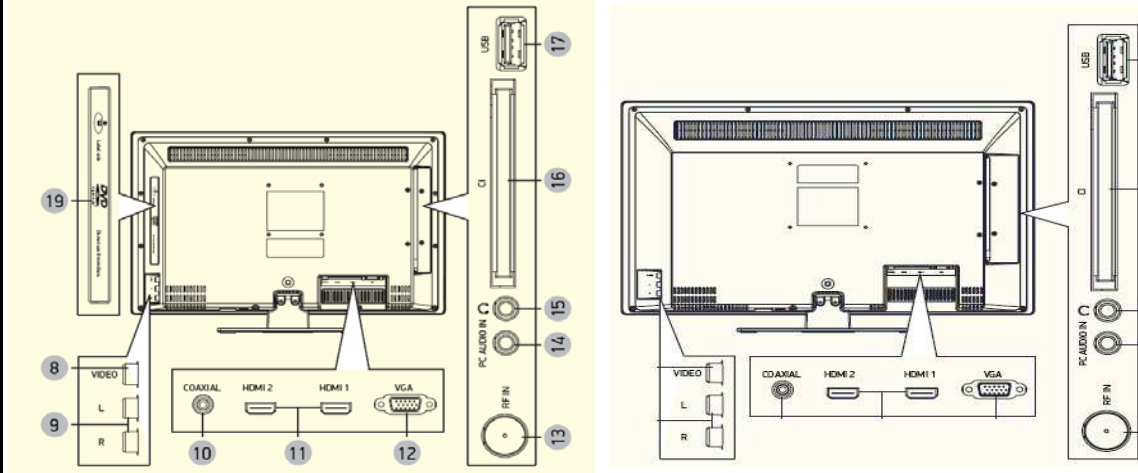
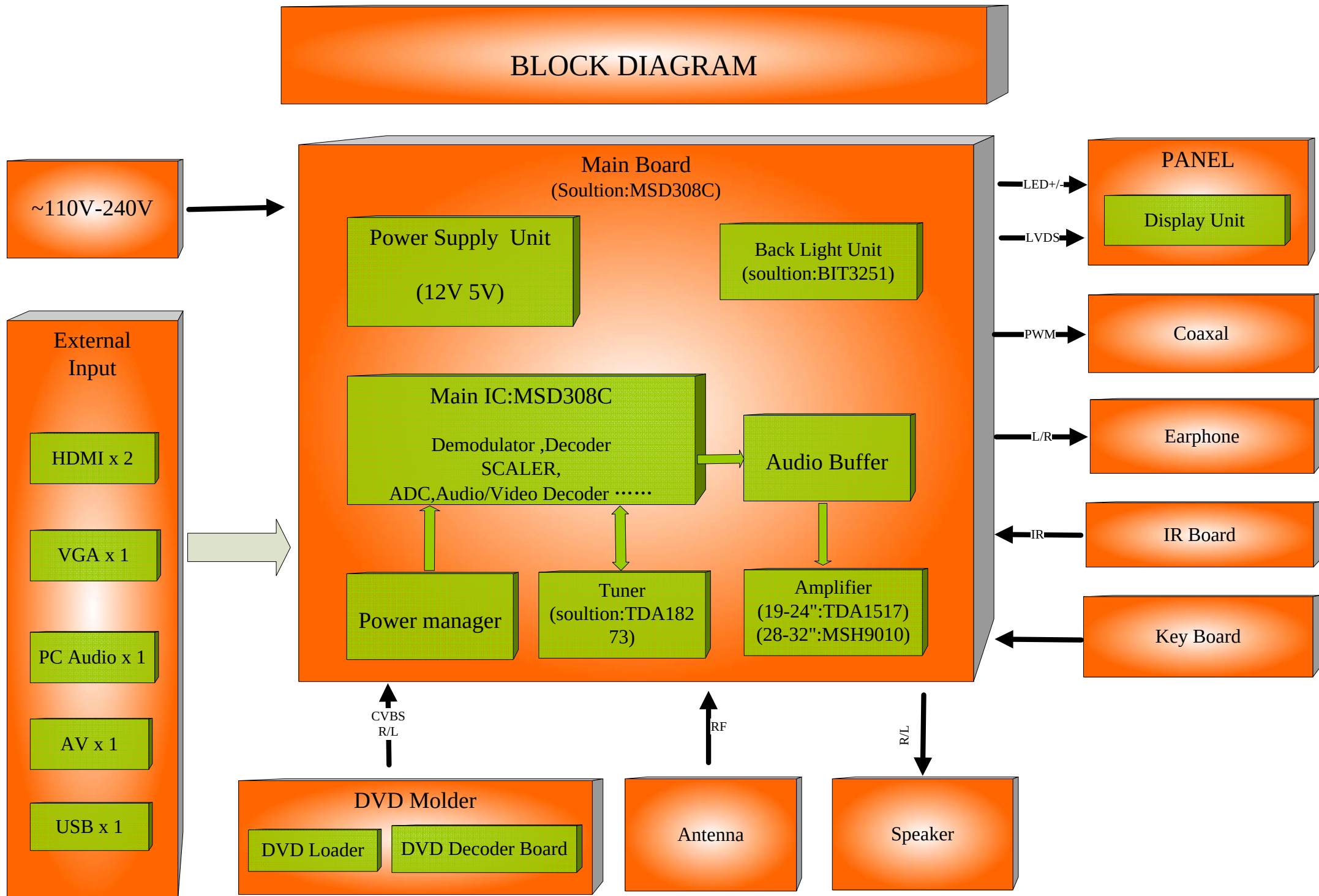
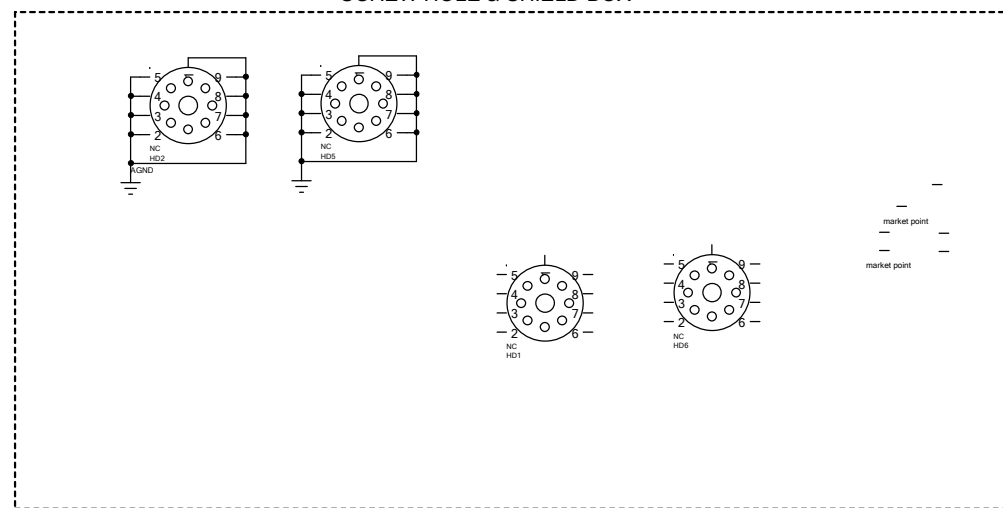
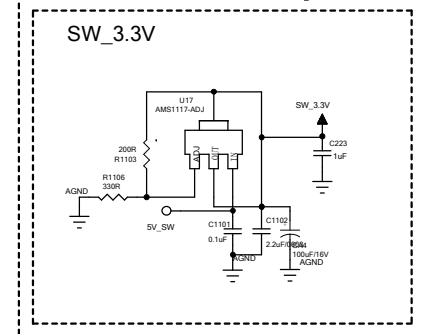
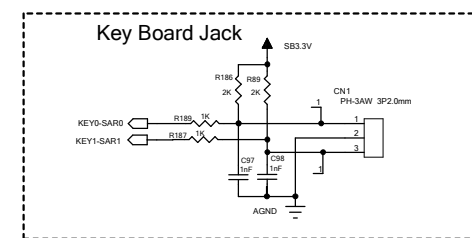
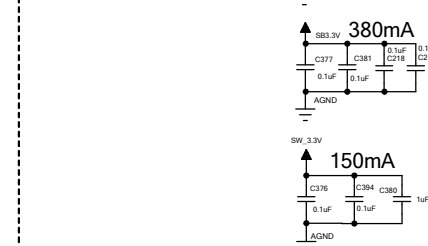
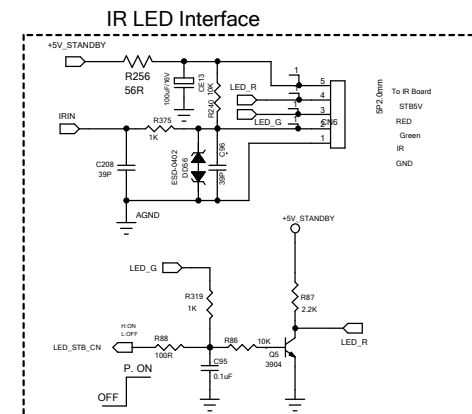
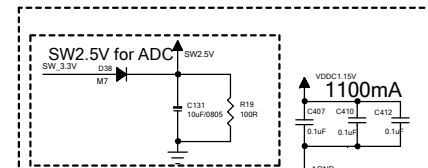
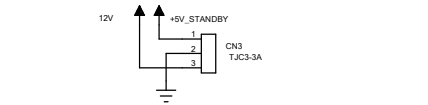
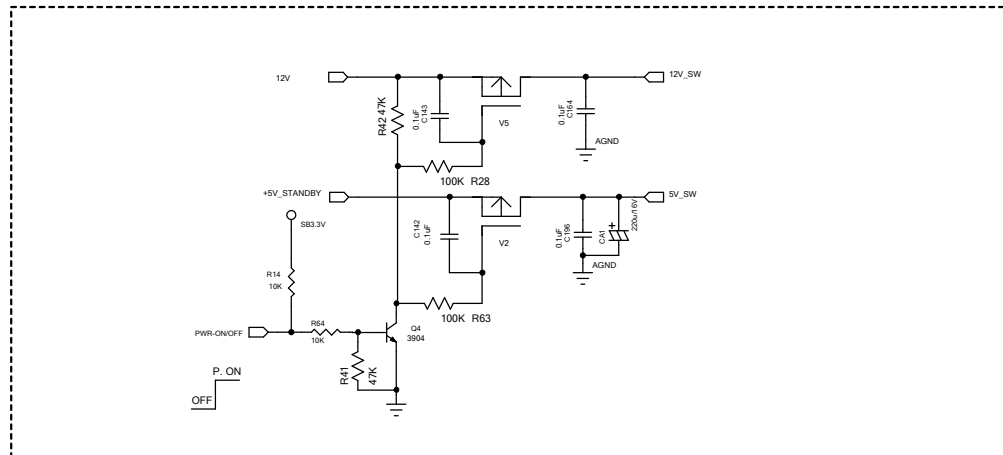
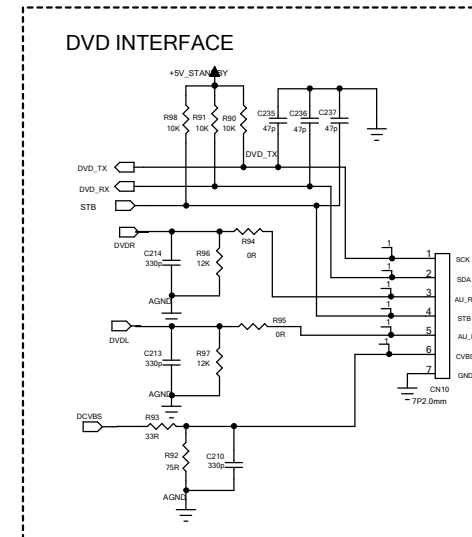
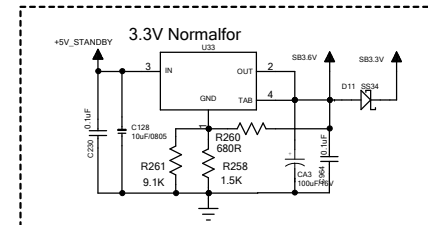
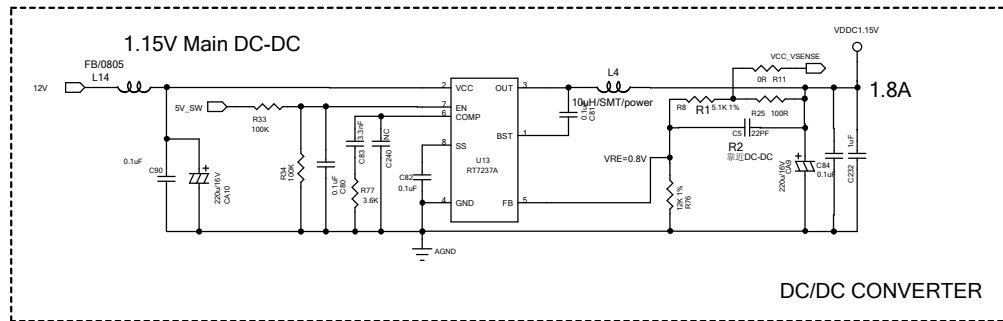
Model	With DVD:19LED-4096/T2C;22LED-6094/FT2C;22LED-4096/FT2C;22LED-4097/FT2C; 24LED-6094/FT2C;24LED-4096/FT2C;24LED-4097/FT2C; NO DVD:24LEM-5093/FT2C;24LEM-5095/FT2C;		
Solution	MSD308C		
ATV System	PAL BG/DK/ I SECAM BG/DK/L		
	48.25~863.25 MHz		
	Picture I.F.	38.90MHz (BG,DK,I)	
	Sound I.F.	32.40MHz(DK,L)	
		32.90MHz(I)	
	Tuning System	FS With PLL	
	Tuner Band	Standard system with hyper band	
	Auto Channel Scanning	Yes	
Number Of Preset Channels	100		
DTV System	DVB-T	COFDM 2K/8K QPSK, 16QAM, 64QAM	
	DVB-T2	COFDM 8K/32K QPSK, 16QAM, 64QAM, 256QAM	
	DVB-C	COFDM 8K/32K QPSK, 16QAM, 64QAM, 256QAM	
	Receiving	VHF (174MHz – 230MHz) UHF (474MHz - 862MHz)	
	Bandwidth	7MHz/8MHz	
	Video System	MPEG-2, MPEG-4,H.264 video decoding	
	Sound System	MPEG Audio,Dolby Digital	
AV	Color system	PAL/NTSC/SECAM	
	Video	1Vp-p@75ohm	
	Audio	500mV rms	
HDMI	Audio	500mVrms	
	Format	Max. 1080P	
Antenna Impedance	75 Ohm Unbalanced		
Power Supply	Power supply: AC 100V-240V, 50/60Hz		
Back Panel Viewing			
	TV KEY	STANDBY,SOURCE, MENU, CH+/CH-, VOL +/-	
	USB2.0 Socket		
Front Panel Viewing			
	LED Indicators (Red/Green)	Standby/On	
Terminals			

	Image In	TV 75ohm Aerial	X 1		
		HDMI Connector	X 2		
		RCA Jack(CVBS) -Yellow	X 1		
Terminals	Audio In	RCA Audio (L/R) Jack - White/Red	X 1		
		φ3.5 Stereo Jack	X 1		
	VGA In	D-sub 15 Pin VGA Connector	X 1		
	USB	USB2.0 Host	X 1		
	COAX Output	RCA Jack (Black) ^{optional}	X 1		
	Audio Output	φ3.5 Earphone Jack	X 1		
Audio	Output Power (1 KHz 10% THD)		2.5W		
	NICAM / STEREO		Yes		
	Bass		Yes		
	Treble		Yes		
	Balance		Yes		
OSD Language	Russian , English				
LCD Panel (Only For Reference, Parameters according to panel model)	Size	19"	22"	24"	
	Brand	skyworth	skyworth	CMI/LG	
	Model	E185SG03	T215S23-L03	M230HGE/LC230EUE-SEA1	
	Size	18.5"	21.5"	23.6"	
	Backlight	LED	LED	LED	
	Pixel Pitch	0.265 mm x 0.265mm	0.265 mm x 0.265mm	0.265 mm x 0.265mm	
	Resolution	(dots)	1366	1920	1920
		(Lines)	768	1080	1080
Support Resolution(For PC)	Horizontal (dots) (Max)			1920	
	Vertical (Lines) (Max)			1080	
Speaker	4 Ohm /5W			x2pcs	
Power Consumption	On working	28W Max	30W Max	36W Max	
	Standby ≤0. 5W				
Remote Control					
	Color	Black			
	Batteries	1.5V AAA X2			
	Customer Code	09F6			
	Remark	RC-LED100			

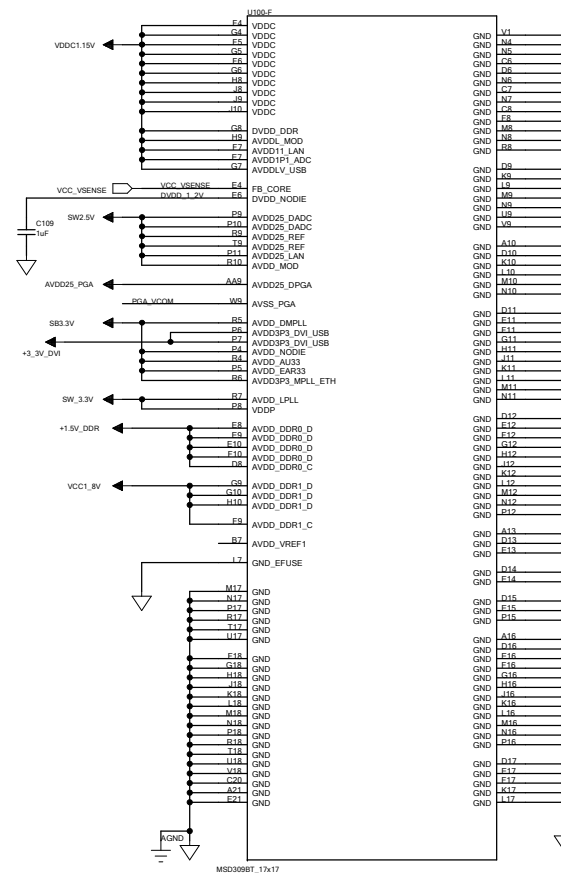
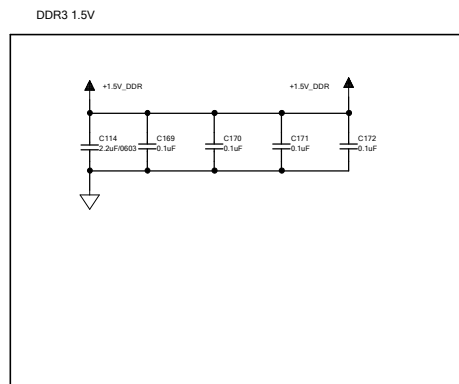
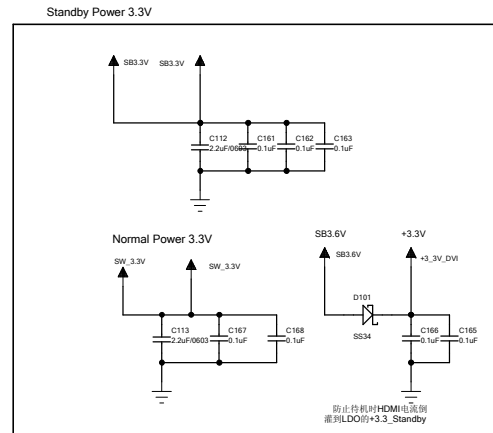
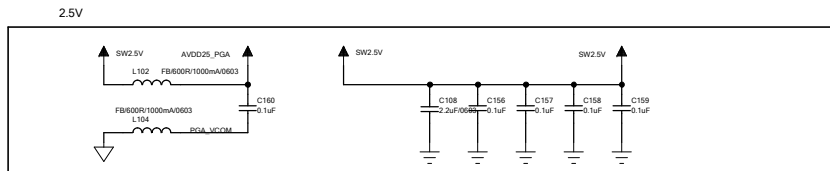
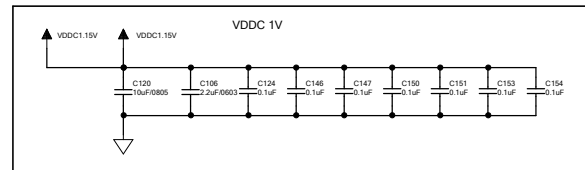
Note: Specifications are subject to change without notice

BLOCK DIAGRAM

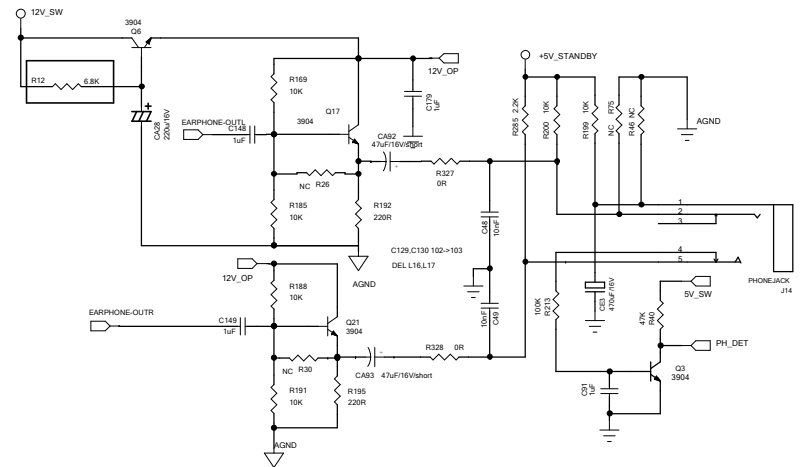




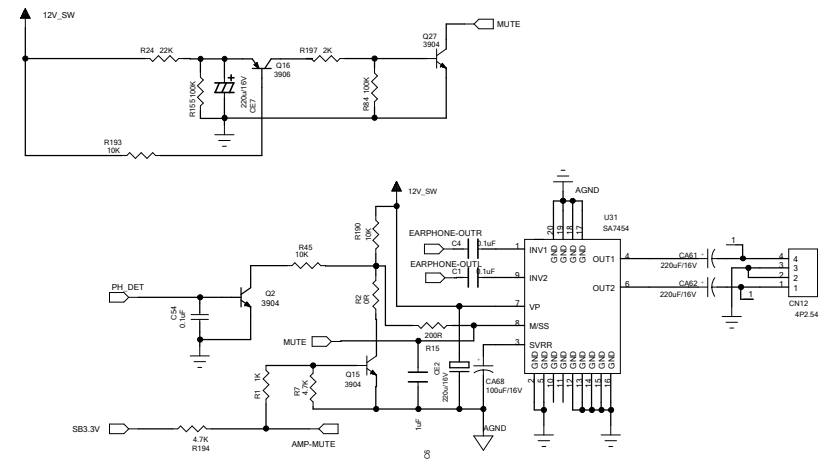
MSD39BT Power interface



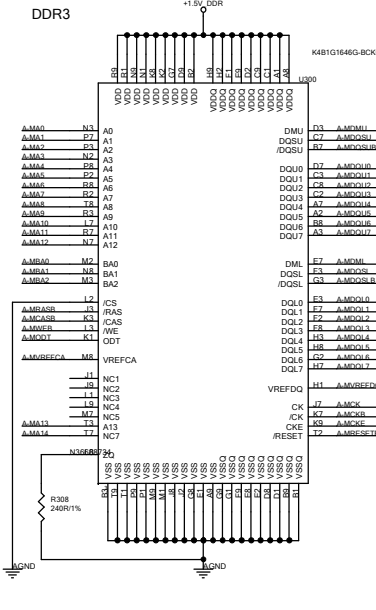
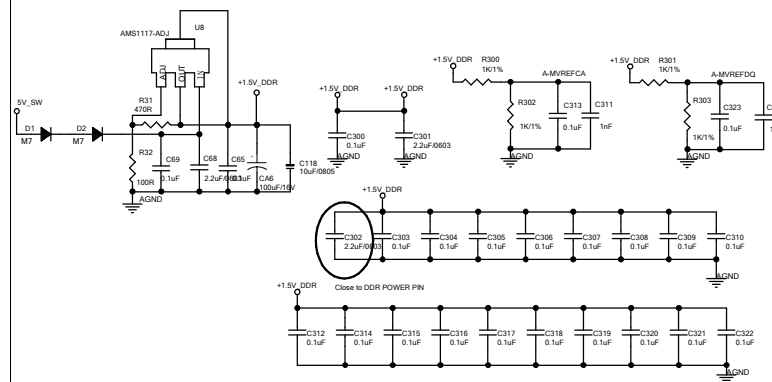
HEADPHONE



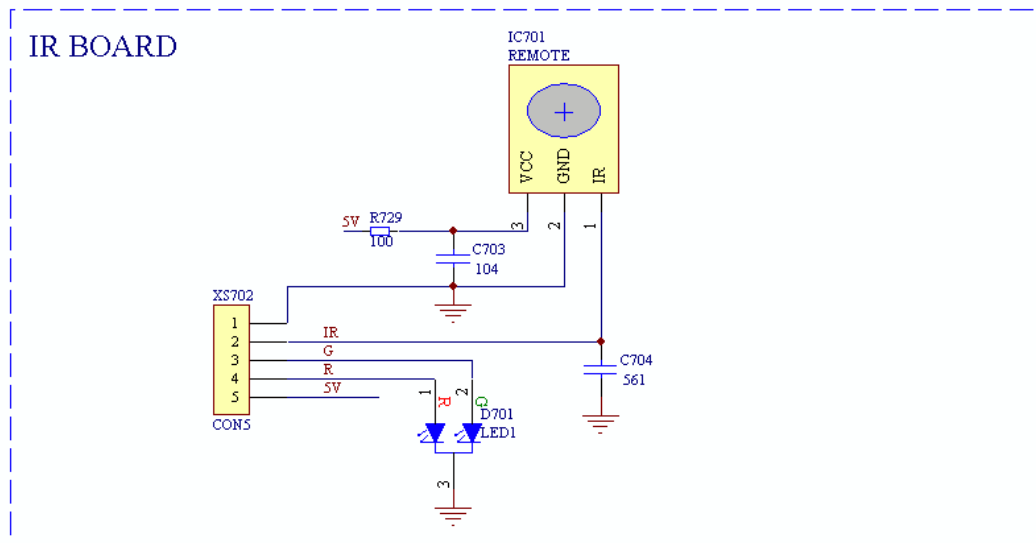
SA7454 AMPLIFIER



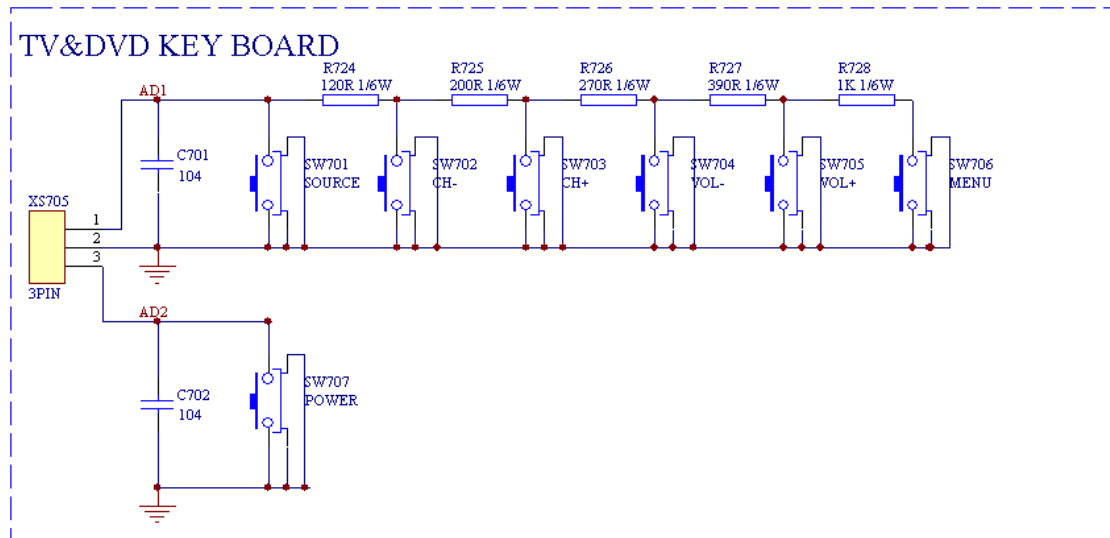
1.5V Normal Power for DDR3



IR BOARD SCHEMATICS



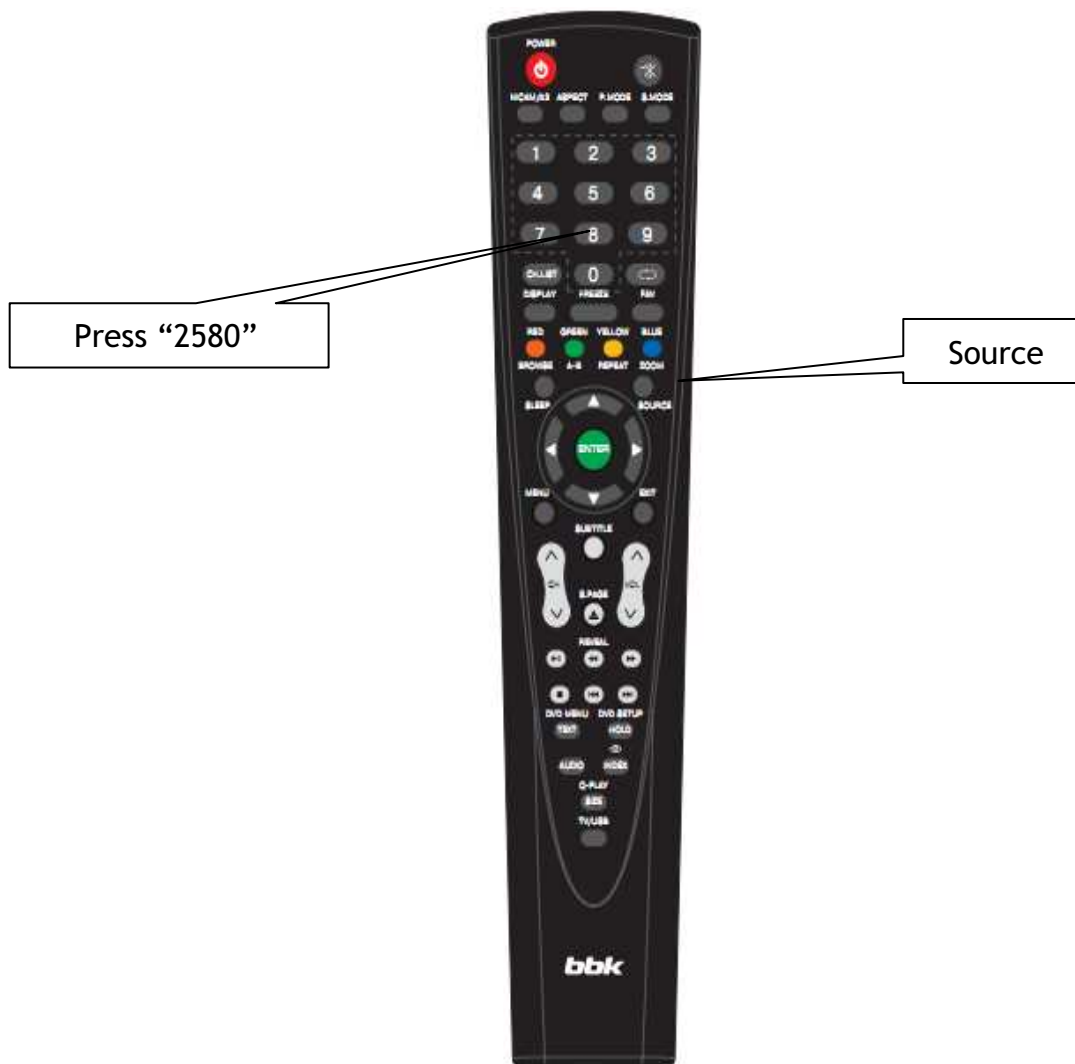
TV&DVD KEY BOARD SCHEMATICS



FACTORY MODE AND ADJUSTMENT

1) How to enter service mode

Press “Source” button on the remote control, then press “2580”, the service menu will be displayed.



Service mode description

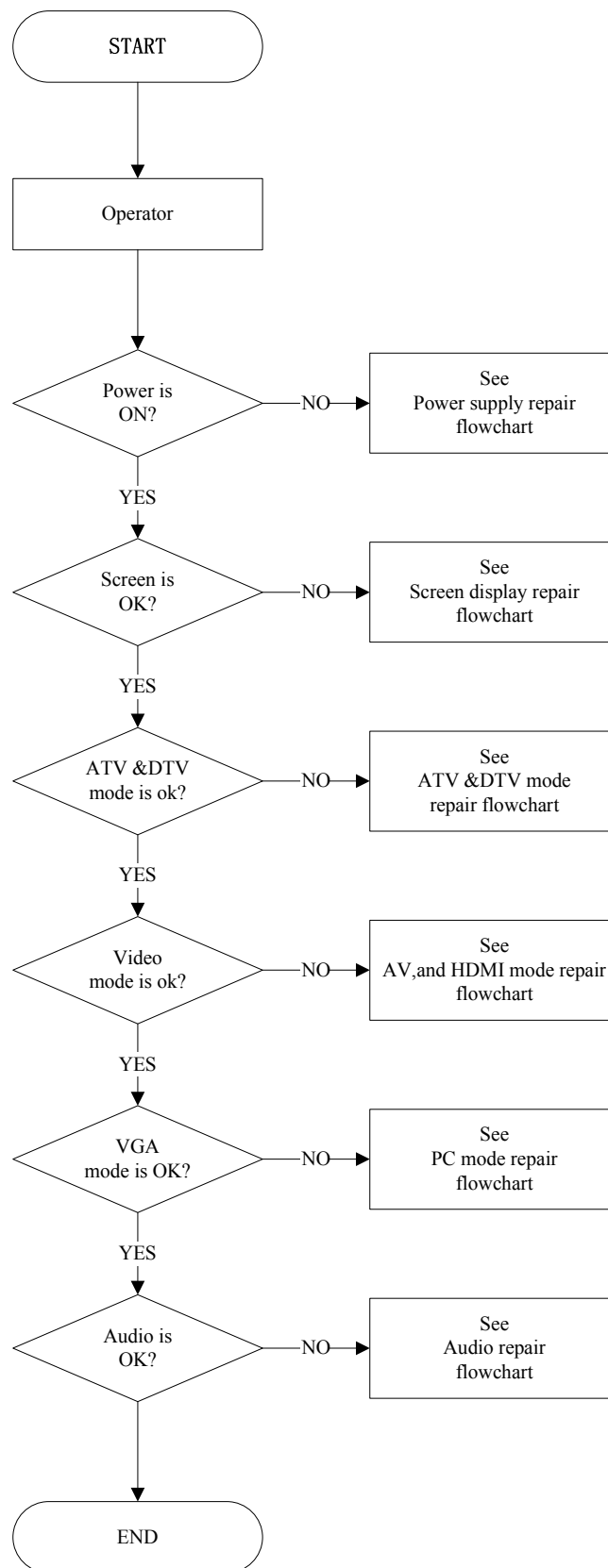
Color Temp: select a color temperature mode that you want to adjust;
R Gain: red gain for white balance adjusting;
G Gain: green gain for white balance adjusting;
B Gain: blue gain for white balance adjusting;
R Offset: red offset for white balance adjusting;
G Gain: green offset for white balance adjusting;
B Gain: blue offset for white balance adjusting;
Aging: to turn on or off aging mode, optional setting: On /Off;
ADC ADJUST: adjust ADC channel difference, only available in VGA mode;
Restore Factory Default: reset setting data to factory default.
Panel Control: select different panel for factory;
DivX:USB Div function switch.

FACTORY MODE AND ADJUSTMENT

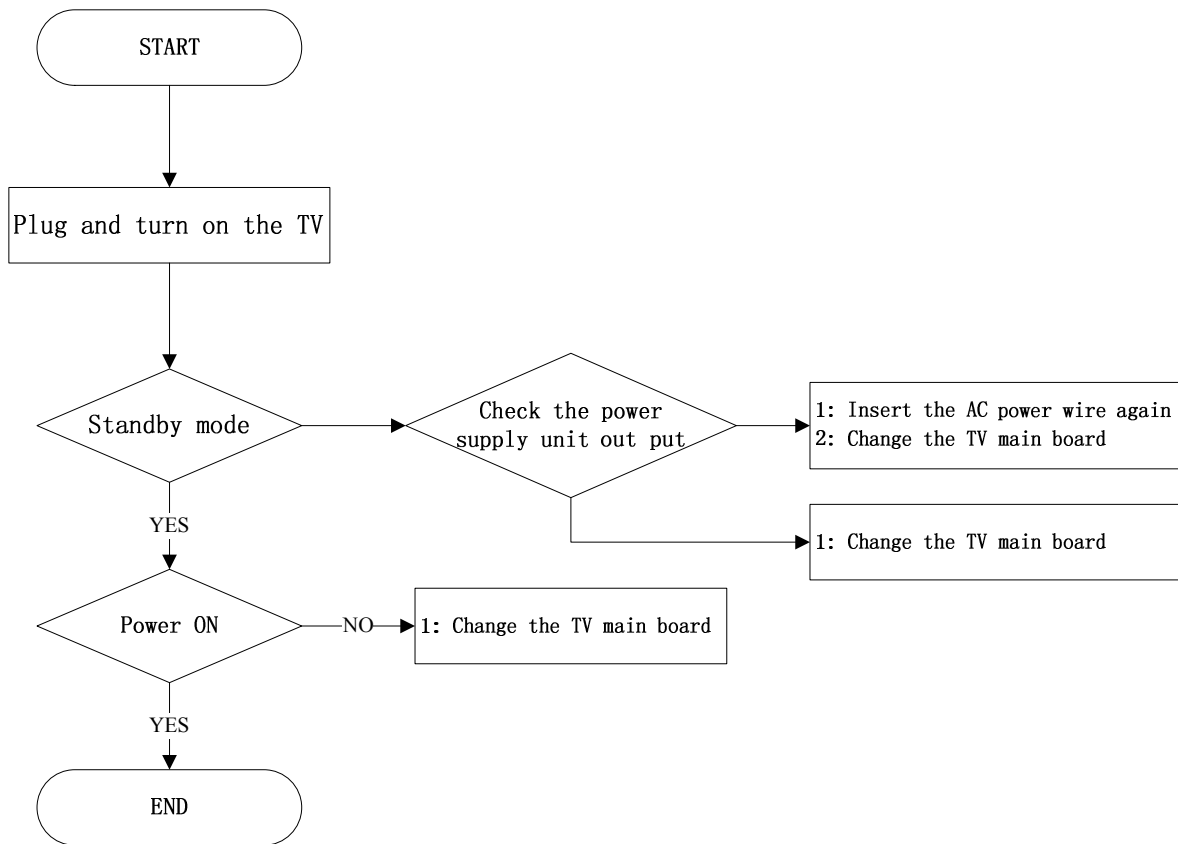
Main Board Software upgrade

- 1 Please burn the software to USB device. Noted please, software name have to be MERGE309B.bin.
- 2 Power on TV, and switch source to ATV.
- 3 Insert USB device to TV, then screen will display a message window to inform you upgrade TV or not. Press" LEFT" direction button to upgrade
- 4 It will cost 40 seconds to upgrade. In this process, please don't unplug USB device, don't power off TV.

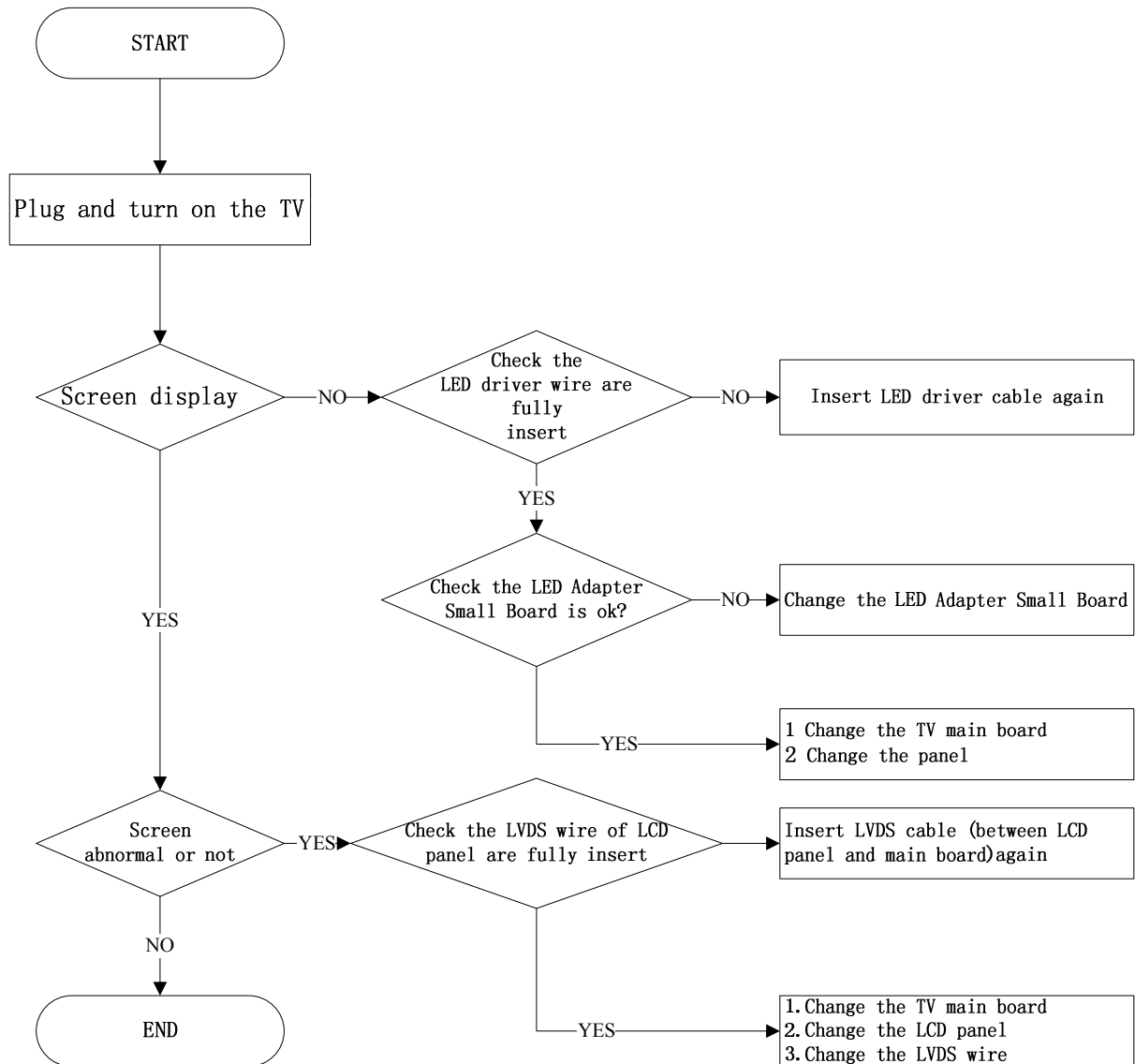
Fault finding tree



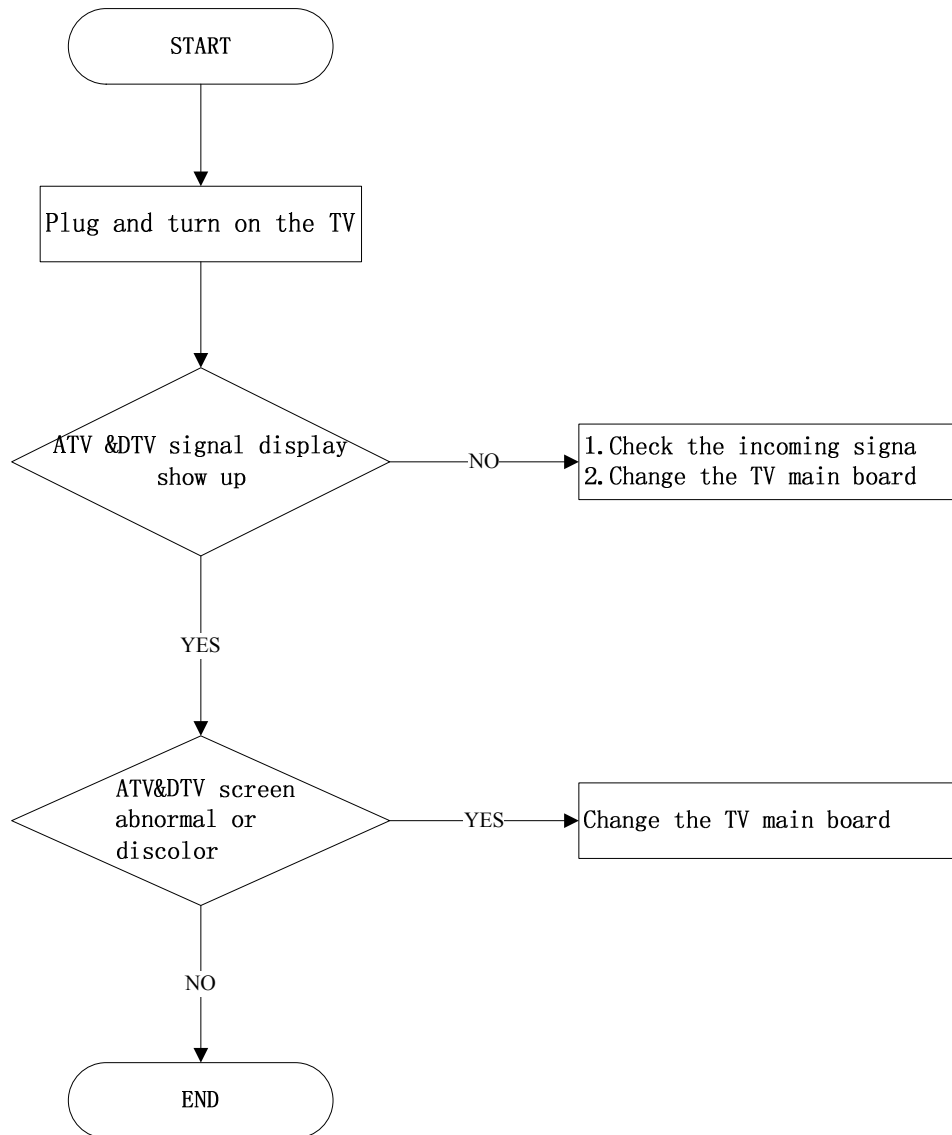
Power supply repair flowchart



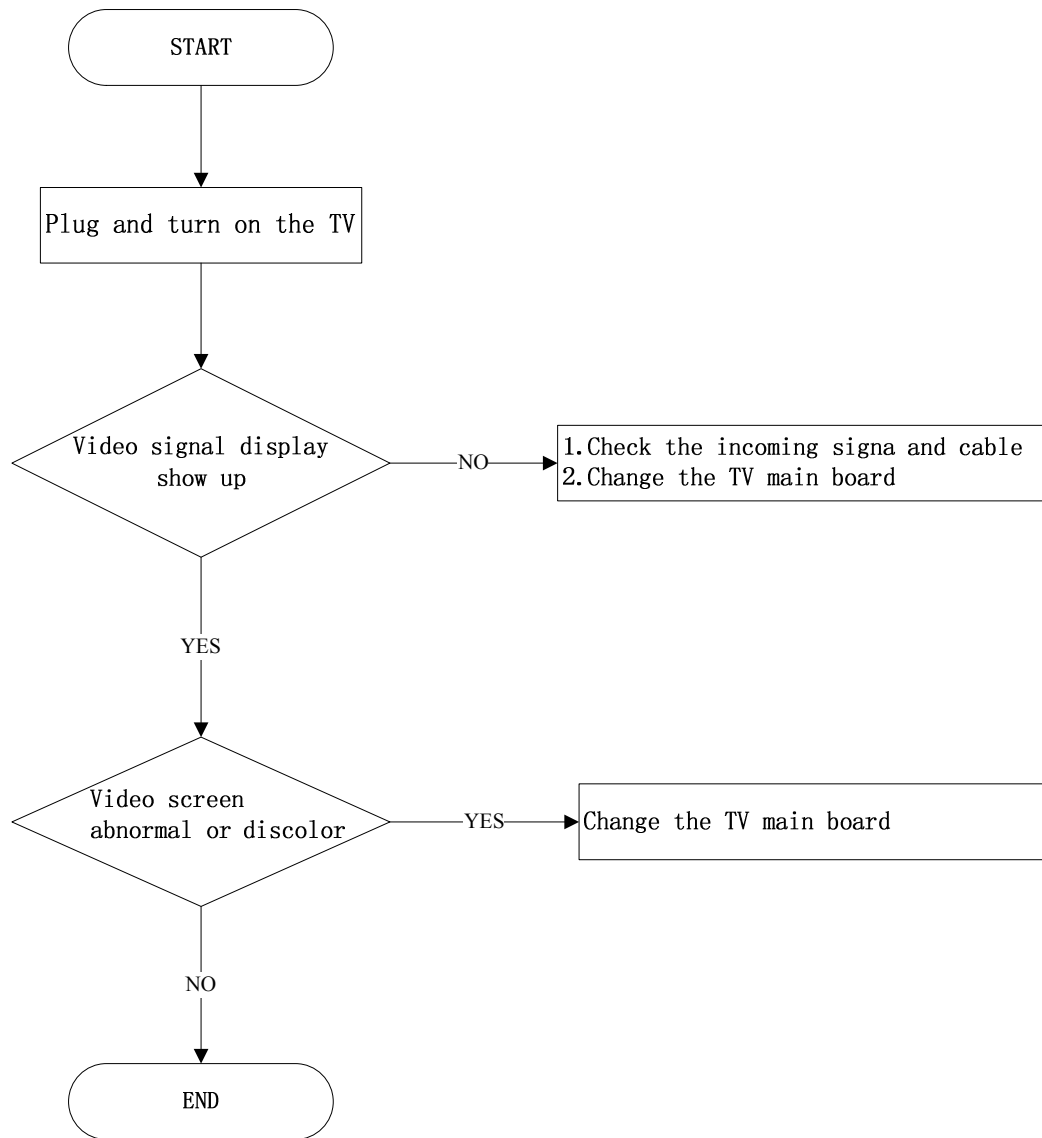
Screen Display repair flowchart



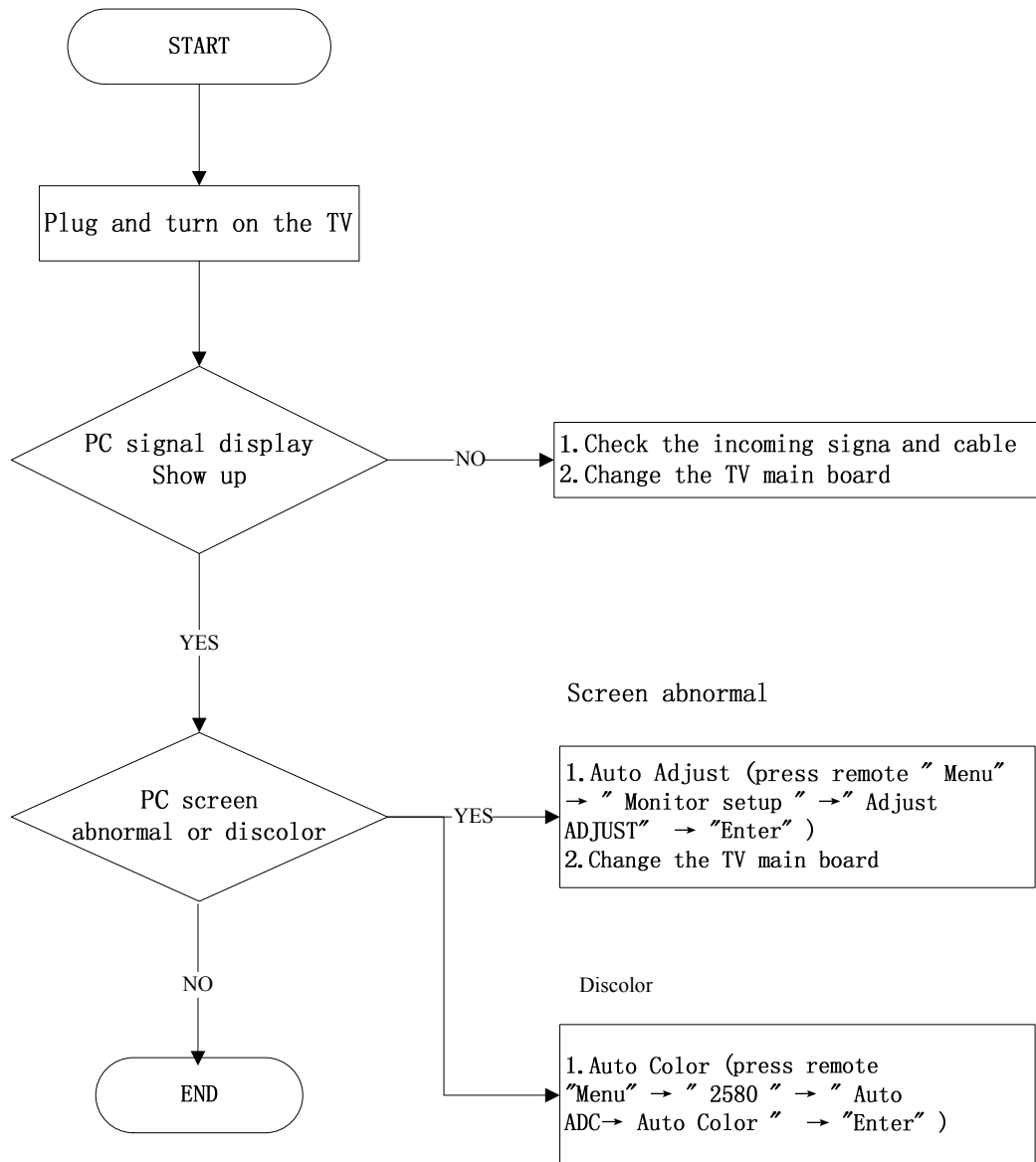
ATV&DTV mode repairflowchart



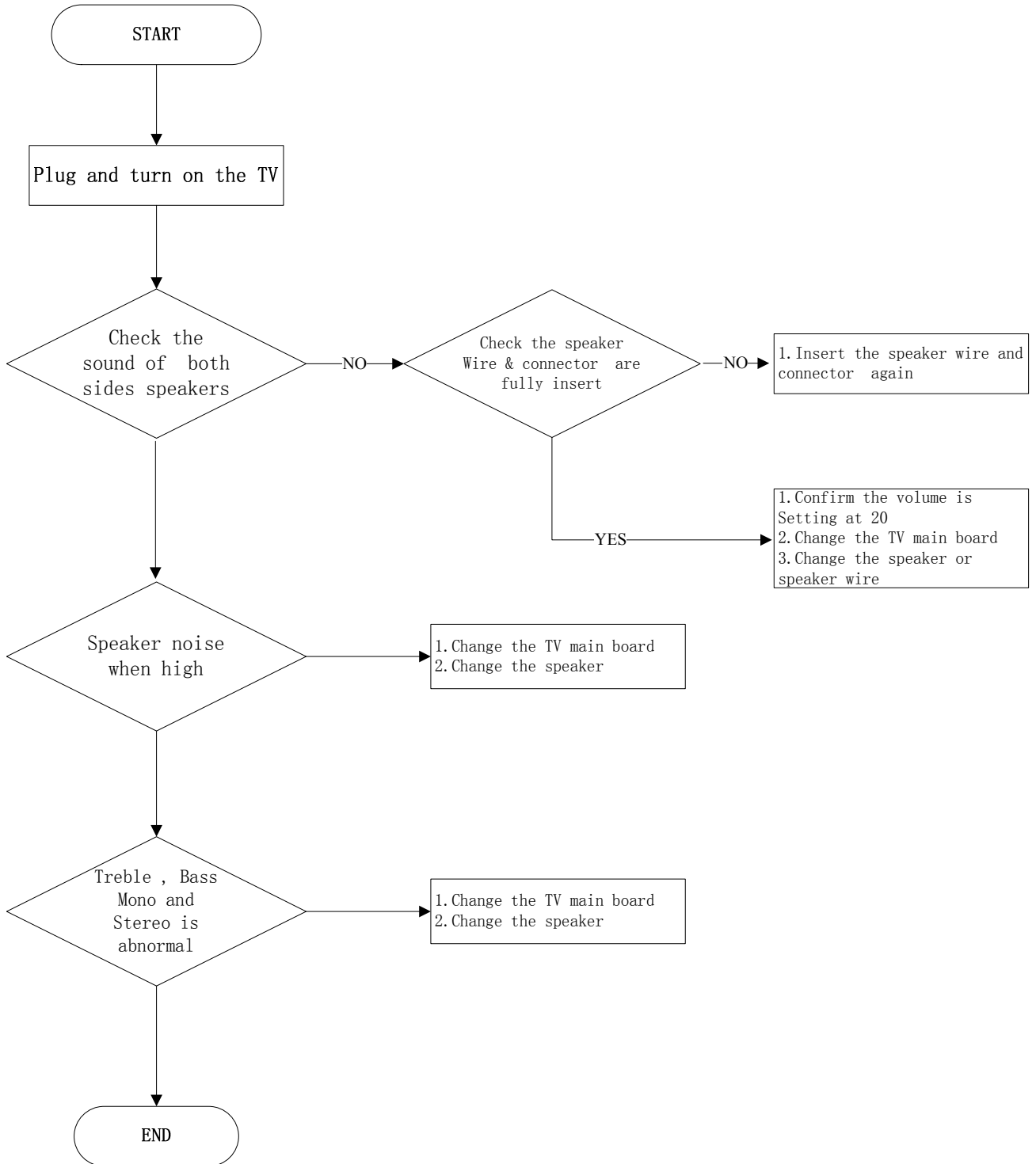
AV, and HDMI1&2 mode repair flowchart



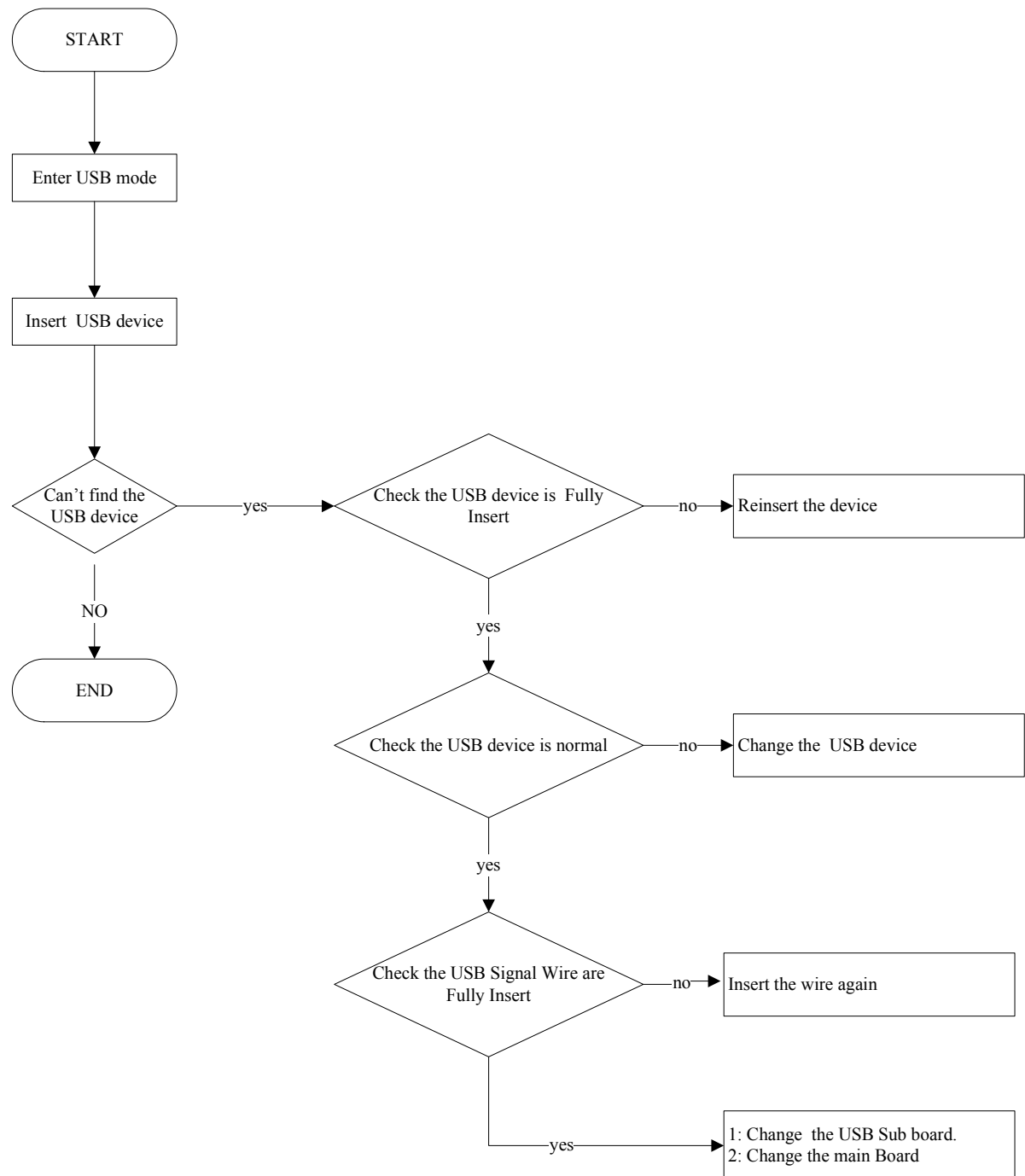
PC mode repairflowchart



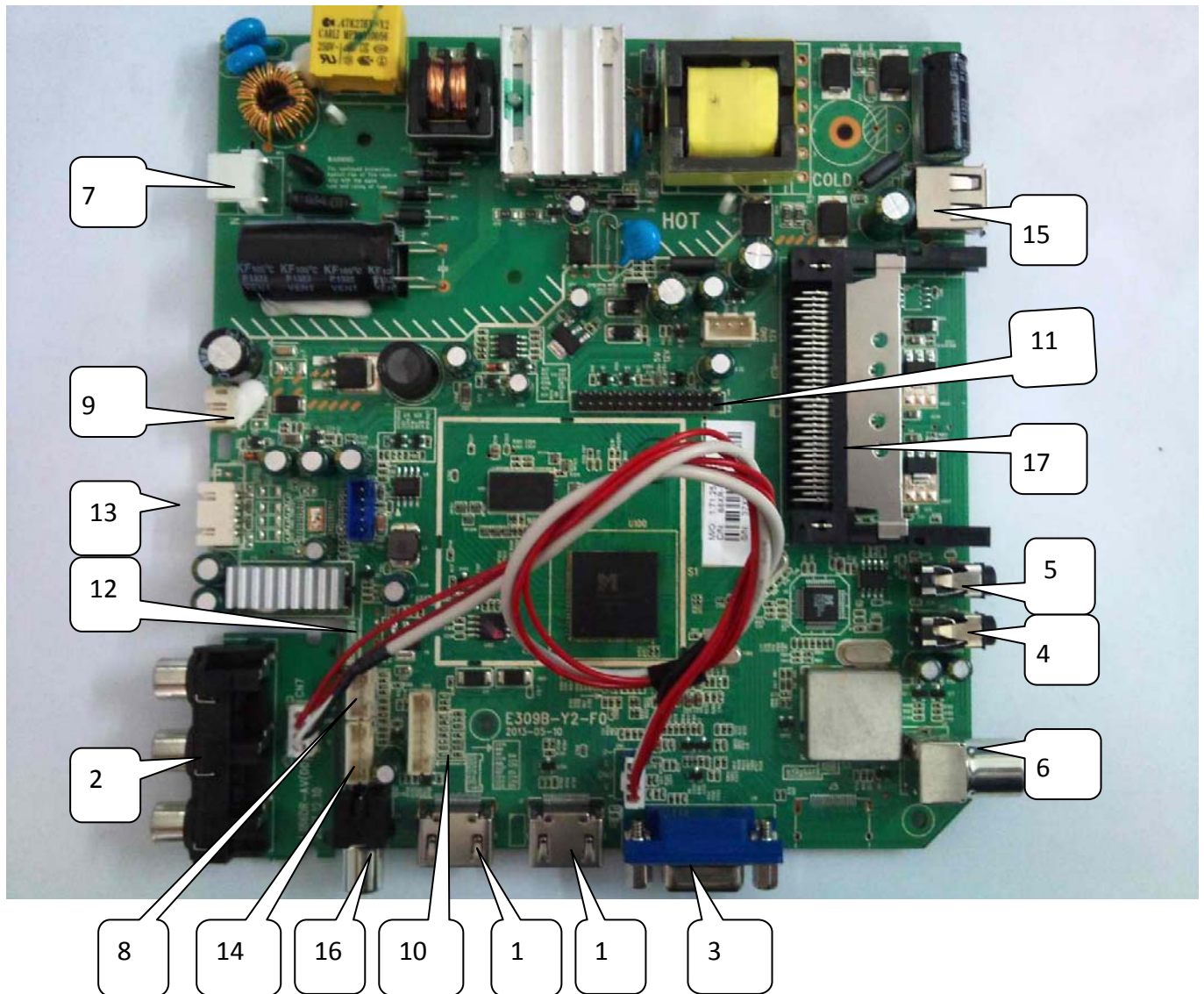
Audio repair flowchart



USB Repair Flowchart



Interface Description



N0	Ref	Description	N0	Ref	Description
1	J2, J4	HDMI Input	10	CN10	DVD Interface
2	CN6	AV Input	11	CON4	LVDS Interface
3	J18	VGA Input	12	CN2	DVD power supply jack
4	J17	PC Audio Input	13	CN12	Speaker Jack
5	J6	Headphone output	14	CN6	IR Jack
6	J11	RF Input	15	J22	USB 2.0 input
7	DP2	AC IN	16	J13	Coaxial output
8	CN104	Key Jack	17	CONN2	PCMCIA SLOT
9	CN4	LED Driver Jack			

★CN4(3PIN2.0) LED Driver Jack

NO.	Definition	Description
1	GND	GND
2	LED-	LED Driver Negative
3	LED+	LED Driver Positive

★CON12(4PIN2.54) Speaker jack

NO.	Definition	Description
1	R	Right Speaker Output
2	GND	GND
3	GND	GND
4	L	Left Speaker Output

★ CN104:(5PIN2.0) Key jack

NO.	Definition	Description
1	K1	Key 1 (ADC Input)
2	GND	GND
3	K2	Key 2 (ADC Input)
4	VCC	VCC5V

★CN10: (7PIN2.0) DVD INTERFACE

NO.	Definition	Description
1	SCK	SPI Communication Protocol SCL
2	SDA	SPI Communication Protocol SDA
3	DRIN	Right Channel of DVD Audio Input
4	STB	SPI Communication Protocol STB
5	DLIN	Left Channel of DVD Audio Input
6	CVBS	DVD Video Signal
7	GND	GND

★CN2: (5PIN2.0) DVD Power jack

NO.	Definition	Description
1	5V	DVD 5V Power Supply
2	5V	DVD 5V Power Supply
3	GND	GND
4	GND	GND
5	GND	GND

★CN6: IR&LED jack

NO.	Definition	Description
1	GND	GND
2	IR	Remote Receiver
3	LED-G	Green Indicator
4	LED-R	Red Indicator
5	5V	Power Supply

★DP2: (2PIN3.94mm) AC Power Input

NO.	Definition	Description
1	N	Internal AC220V Power Supply
2	L	Internal AC220V Power Supply

★J22: (4PIN2.0)

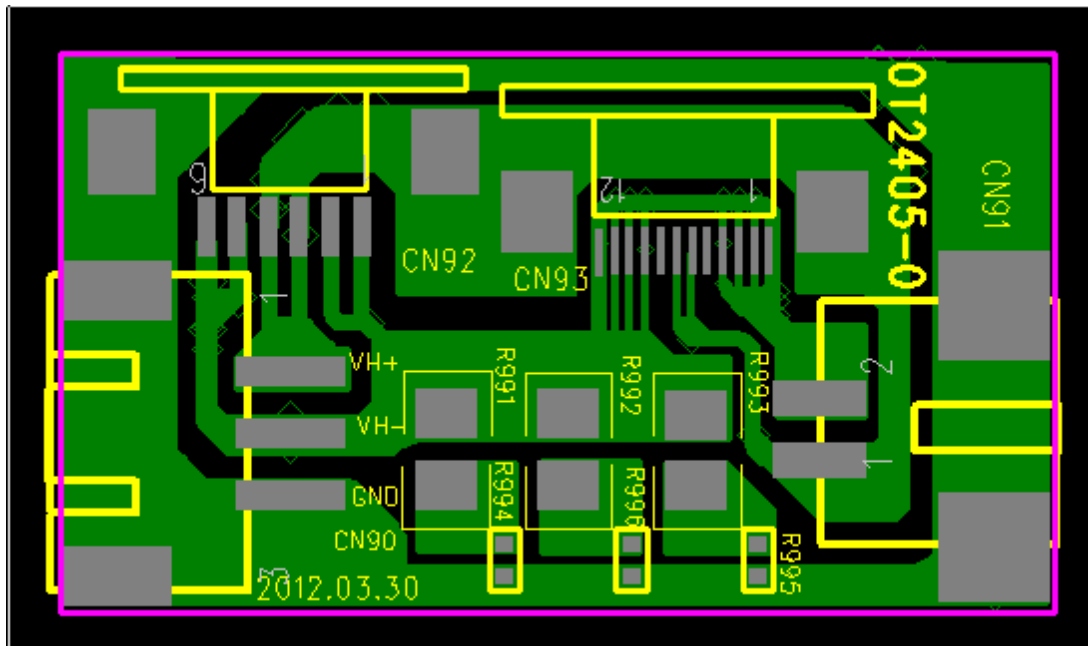
NO.	Definition	Description
1	5V	USB 5V Power Supply
2	D-	USB Negative Signal
3	D+	USB Positive Signal
4	GND	GND

★CON4: LVDS Interface

NO.	Definition	Description
1	LCD-VDD	Power for Panel
2	LCD-VDD	Power for Panel
3	LCD-VDD	Power for Panel
4	GND	GND
5	GND	GND
6	GND	GND
7	GND	GND
8	GND	GND
9	EDA3+	LVDS EVEN3+ Signal
10	EDA3-	LVDS EVEN3+ Signal
11	ECK+	LVDS EVEN Clock + Signal
12	ECK-	LVDS EVEN Clock - Signal
13	EDA2+	LVDS EVEN2 + Signal
14	EDA2-	LVDS EVEN2 - Signal
15	EDA1+	LVDS EVEN1 + Signal
16	EDA1-	LVDS EVEN1 - Signal
17	EDA0+	LVDS EVEN0 + Signal
18	EDA0-	LVDS EVEN0 - Signal
19	GND	GND
20	GND	GND
21	ODA3+	LVDS ODD3 + Signal
22	ODA3-	LVDS ODD3 + Signal
23	OCK+	LVDS ODD Clock + Signal
24	OCK-	LVDS ODD Clock - Signal
25	ODA2+	LVDS ODD2 + Signal
26	ODA2-	LVDS ODD2 - Signal
27	ODA1+	LVDS ODD1 + Signal
28	ODA1-	LVDS ODD1 - Signal
29	ODA0+	LVDS ODD0 + Signal
30	ODA0-	LVDS ODD0 - Signal

LED Adapter Small Board

OT2450 is a LED adaptor board, to work with FSE060E together. By configuring the circuit parameter for OT2450, so that the FSE060E output current value is used to meet the needs of a variety of panel's backlight current.



CN90: (3PIN2.0) Connect to Power Supply Board

NO.	Definition	Description
1	VH+	LED anode
2	VH-	LED cathode
3	GND	Ground

CN90: (6PIN1.0mm) Connect to Panel

Pin number	Output Name
1	IRLED(Current Out)
2	IRLED(Current Out)
3	VLED(Voltage in)
4	VLED(Voltage in)
5	IRLED(Current Out)
6	IRLED(Current Out)

CN92: (12PIN0.5mm) Connect to panel

Pin number	Output Name
1	IRLED(Current Out)
2	IRLED(Current Out)
3	IRLED(Current Out)
4	IRLED(Current Out)
5	NC
6	VLED(Voltage in)
7	VLED(Voltage in)
8	NC
9	IRLED(Current Out)
10	IRLED(Current Out)
11	IRLED(Current Out)
12	IRLED(Current Out)

CN91: (2PIN2.0) Connect to panel

Pin number	Output Name
1	VLED(Voltage in)
2	IRLED(Current Out)

How to configure the circuit parameter

SIZE	PANEL	CN90	CN91	R993	R995
18.5"	E185SG01	3P2.0mm	2P2.0mm	2.4 Ω	0 Ω
21.5"	CE21M21A	3P2.0mm	2P2.0mm	2 Ω	0 Ω
23.0"	M230HGE L20	3P2.0mm	2P2.0mm	1.8 Ω	0 Ω

文件名称	LCD Module Specification 液晶模组规格书	页次	1 / 26
产品名称	T215S23-L03 LED 液晶模组	版次	1.0

承认(规格)书

Specification Sheet

客户:

(Customer Name) _____

创维 品名:

(Skyworth Material Name) _____ T215S23-L03

创维 料号:

(Skyworth Material Number) _____

客户 料号:

(Customer Material Number) _____

规格书版本:

(Spec Approval Sheet Version) _____ V 1.0

客户承认 Customer		创维承认 Skyworth	
Approved by 承认	Checked by 审核	Approved by 承认	
		Checked by 审核	
		Designed by 编写	

创维-RGB 电子有限公司

文件名称	LCD Module Specification 液晶模组规格书	页次	2 / 26
产品名称	T215S23-L03 LED 液晶模组	版次	1.0

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Revision History

[illegible]

创维-RGB 电子有限公司

文件名称	LCD Module Specification 液晶模组规格书	页次	4 / 26
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1. GENERAL DESCRIPTION

1.1 OVERVIEW

T215S23-L03 is a 21.5" TFT Liquid Crystal Display module with white LED Backlight unit and 30 pin 1ch-LVDS interface. This module supports 1920 x 1080 WXGA model and can display up to 16.7millions colors, Open cell: M215HTN01.1 (Source: AUO)

1.2 FEATURES

- Ultra-high contrast ratio
- Fast response time
- Brightness 250 nits
- WXGA(1920 x1080Spixels) resolution.
- DE (Data Enable) only mode.
- LVDS (Low Voltage Differential Signaling) interface.
- ROHS compliance

1.3 APPLICATION

- TFT LCD TVs
- Display terminals for AV application

1.4 GENERAL SPECIFICATIONS

Item	Specification	Unit	Note
Active Area	476.64 (H) × 268.11(V)	mm	(1)
Bezel Opening Area	479.84(H) × 271.31 (V)	mm	(1)
Driver Element	a-Si TFT active matrix	-	-
Pixel Number	1920x R.G.B. x 1080	pixel	-
Pixel Pitch	0.248(H) x 0.248 (V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	16.7 millions	color	-
Display Operation Mode	Normally white	-	-
Surface Treatment	Hard coating (3H), AG (Haze 25%)	-	-

1.5 MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal(H)	495.4	495.6	495.8	mm	(1)
	Vertical(V)	292	292.2	292.4	mm	(1)
	Depth(sD)	10.7	10.8	10.9	mm	(1)
Weight			2590		g	-

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2. ABSOLUTE MAXIMUM RATINGS

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions and the dimension of bosses are not included.

2.1 ABSOLUTE RATINGS OF ENVIRONMENT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T _{ST}	-20	60	°C	(1)
Operating Ambient Temperature	T _{OP}	0	50	°C	(1), (2)
Shock (Non-Operating)	S _{NOP}	-	50	G	(3), (5)
Vibration (Non-Operating)	V _{NOP}	-	1.5	G	(4), (5)

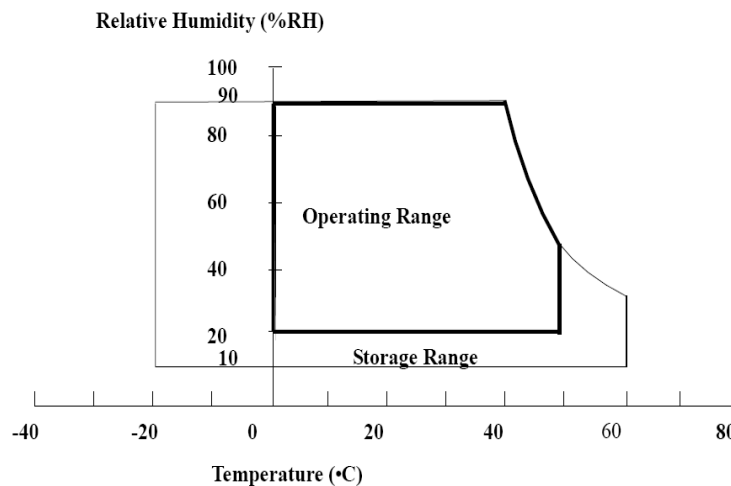
Note (1) Temperature and relative humidity range is shown in the figure below.

(a) 90 %RH Max. ($T_a \leq 40^\circ\text{C}$).

(b) Wet-bulb temperature should be 39°C Max. ($T_a > 40^\circ\text{C}$).

(c) No condensation.

Note (2) The temperature of panel surface should be 0°C Min and 60°C Max.



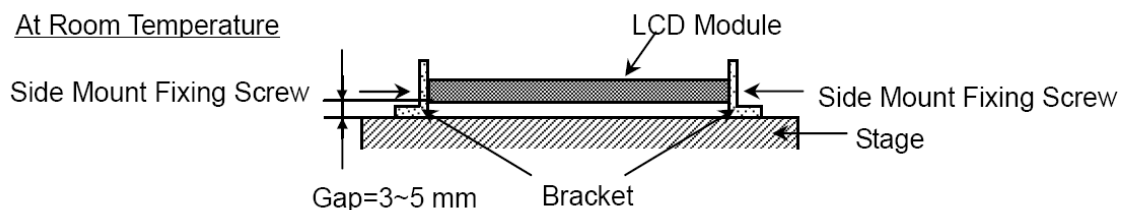
Note (3) 50G, 11ms, half sine wave, 1 time for $\pm X$, $\pm Y$, $\pm Z$.

Note (4) 10 ~ 300 Hz, sweep rate 10min/cycle, 1 time each X, Y, Z.

Note (5) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.

The fixing condition is shown as below

At Room Temperature



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2.2 ELECTRICAL ABSOLUTE RATINGS

2.2.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	VDD	-0.3	6	V	(1)

2.2.2 BACKLIGHT UNIT

Item	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Input Voltage	V _{in}	23	-	29	V	(1)
Input Current	I _{in}		390	-	mA	

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.

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3. ELECTRICAL CHARACTERISTICS

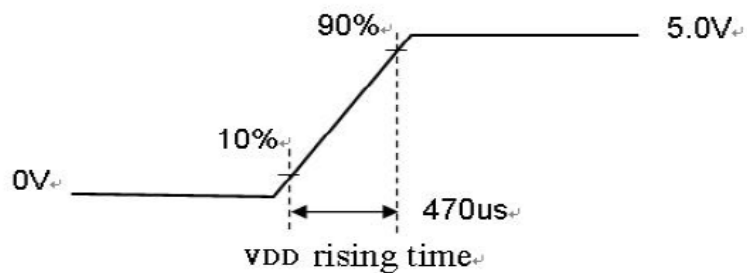
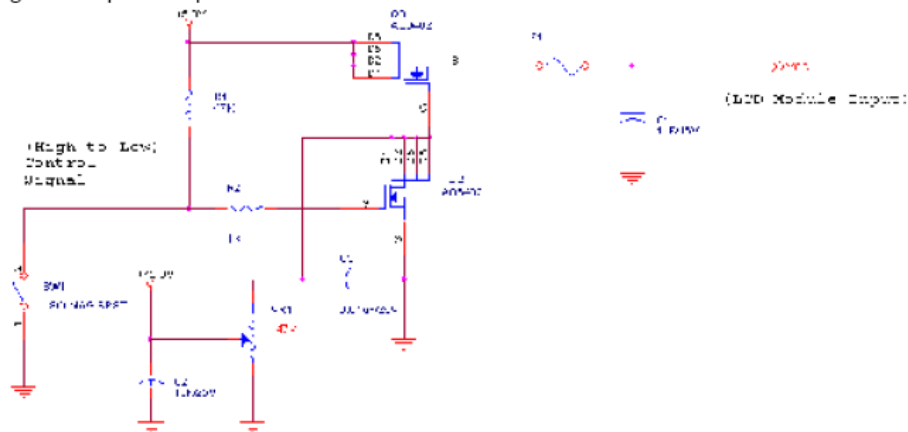
3.1 TFT LCD MODULE

Input power specifications are as following:

Symbol	Parameter	Min	Typ	Max	Unit	Conditions
VDD	Logic/LCD Drive Voltage	4.5	5.0	5.5	[Volt]	+/-10%
IDD	Input Current	-	1.13	1.36	[A]	VDD= 5.0V, All Black Pattern At 60Hz
			1.34	1.61	[A]	VDD= 5.0V, All Black Pattern At 75Hz
PDD	VDD Power	-	5.65	6.80	[Watt]	VDD= 5.0V, All Black Pattern At 60Hz
			6.7	8.05	[Watt]	VDD= 5.0V, All Black Pattern At 75Hz
IRush	Inrush Current	-	-	3	[A]	Note 1
VDDrp	Allowable Logic/LCD Drive Ripple Voltage	-	-	500	[mV] p-p	VDD= 5.0V, All Black Pattern At 75Hz

Note 1: Measurement conditions:

The duration of rising time of power input is 470us.



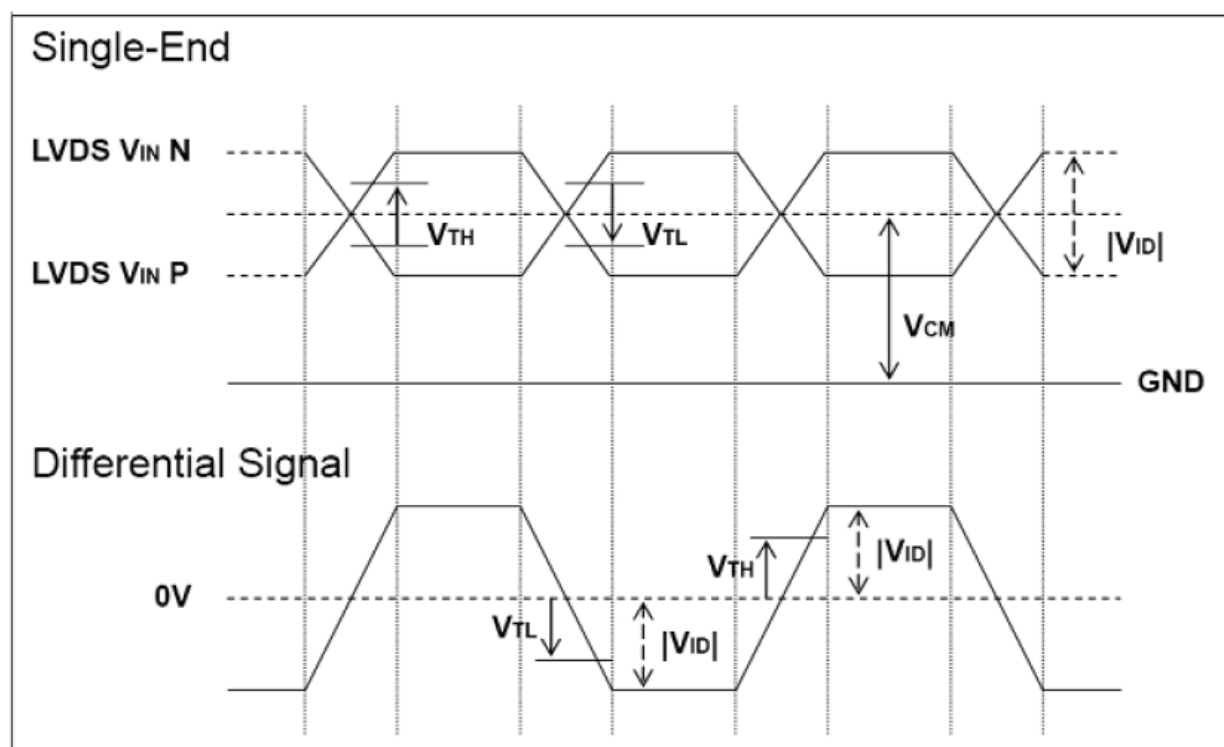
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Signal Electrical Characteristics

Characteristics of each signal are as following:

Symbol	Parameter	Min	Typ	Max	Units	Condition
V_{TH}	Differential Input High Threshold	-	-	+100	[mV]	$V_{CM} = 1.2V$ Note 1
V_{TL}	Differential Input Low Threshold	-100	-	-	[mV]	$V_{CM} = 1.2V$ Note 1
$ V_{ID} $	Input Differential Voltage	100	-	600	[mV]	Note 1
V_{CM}	Differential Input Common Mode Voltage	+1.0	+1.2	+1.5	[V]	$V_{TH} - V_{TL} = 200MV$ (max) Note 1

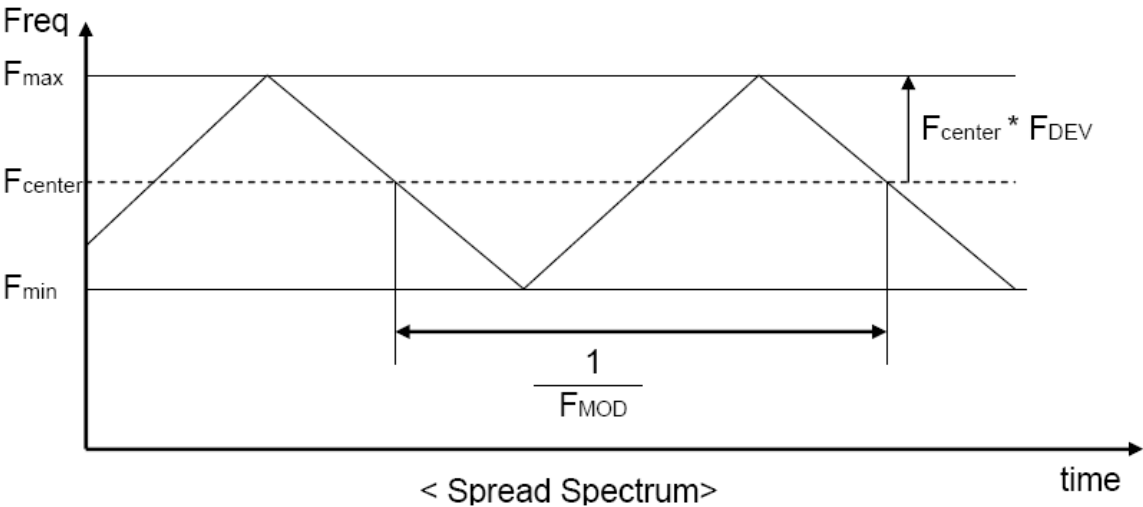
Note 1: LVDS Signal Waveform



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AC characteristic

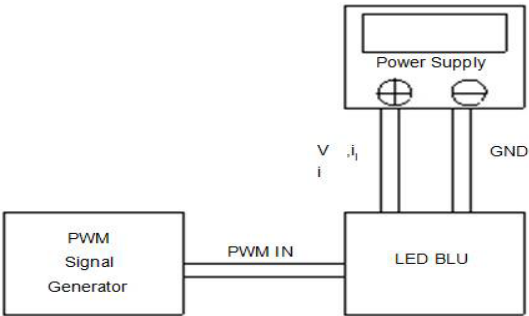
Description	Symbol	Min	Max	Unit	Note
Maximum deviation of input clock frequency during SSC	F_{DEV}	-	± 3	%	
Maximum modulation frequency of input clock during SSC	F_{MOD}	-	200	KHz	



BACKLIGHT UNIT (Ta = 25 ± 2 °C)

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Converter Input Voltage	V_i	23	-	29	V _{DC}	Duty 100%
Converter Input Current	I_i		0.39	-	A _{DC}	Duty 100%
LED Life Time	L_{BL}	(30,000)		-	Hrs	(1)

Note (1) The life time of LED is defined as the time when it continues to operate under the condition at Ta = 25±2℃ and I = 480 mA(Per EA) until the brightness becomes ≧ 50% of its original value.



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4. INPUT TERMINAL PIN ASSIGNMENT

Connector & Pin Assignment

Physical interface is described as for the connector on module. These connectors are capable of accommodating the following signals and will be following components.

TFT LCD Module

Connector Name / Designation	Interface Connector / Interface card
Manufacturer	P-TWO, STM
Type Part Number	P-TWO AL230F-A0G1D-P STM MSCKT2407P30HB
Mating Housing Part Number	FI-X30HL (Locked Type)

Pin Assignment

Pin#	Signal Name	Pin#	Signal Name
1	RxO0-	2	RxO0+
3	RxO1-	4	RxO1+
5	RxO2-	6	RxO2+
7	GND	8	RxOCLKIN-
9	RxOCLKIN+	10	RxO3-
11	RxO3+	12	RxE0-
13	RxE0+	14	GND
15	RxE1-	16	RxE1+
17	GND	18	RxE2-
19	RxE2+	20	RxECLKIN-
21	RxECLKIN+	22	RxE3-
23	RxE3+	24	GND
25	NC (for AUO test only. Do not connect)	26	NC (for AUO test only. Do not connect)
27	NC (for AUO test only. Do not connect)	28	VDD
29	VDD	30	VDD

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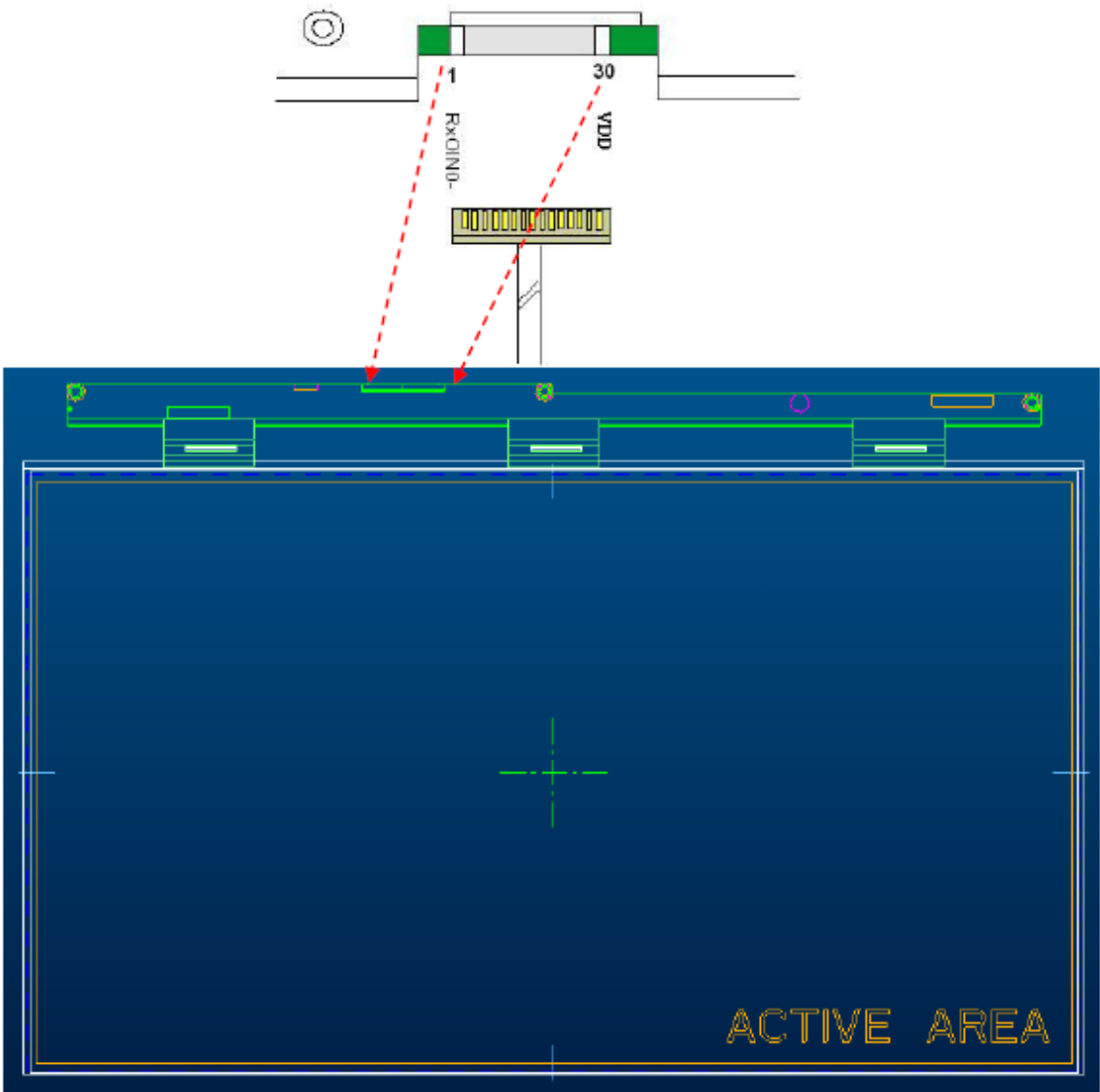
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Signal Description

PIN #	SIGNAL NAME	DESCRIPTION
1	RxO0-	Negative LVDS differential data input (Odd data)
2	RxO0+	Positive LVDS differential data input (Odd data)
3	RxO1-	Negative LVDS differential data input (Odd data)
4	RxO1+	Positive LVDS differential data input (Odd data)
5	RxO2-	Negative LVDS differential data input (Odd data)
6	RxO2+	Positive LVDS differential data input (Odd data)
7	GND	Power Ground
8	RxOCLK-	Negative LVDS differential clock input (Odd clock)
9	RxOCLK+	Positive LVDS differential clock input (Odd clock)
10	RxO3-	Negative LVDS differential data input (Odd data)
11	RxO3+	Positive LVDS differential data input (Odd data)
12	RxE0-	Negative LVDS differential data input (Even data)
13	RxE0+	Positive LVDS differential data input (Even data)
14	GND	Power Ground
15	RxE1-	Negative LVDS differential data input (Even data)
16	RxE1+	Positive LVDS differential data input (Even data)
17	GND	Power Ground
18	RxE2-	Negative LVDS differential data input (Even data)
19	RxE2+	Positive LVDS differential data input (Even data)
20	RxECLK-	Negative LVDS differential clock input (Even clock)
21	RxECLK+	Positive LVDS differential clock input (Even clock)
22	RxE3-	Negative LVDS differential data input (Even data)
23	RxE3+	Positive LVDS differential data input (Even data)
24	GND	Power Ground
25	NC	No connection (for AUO test only. Do not connect)
26	NC	No connection (for AUO test only. Do not connect)
27	NC	No connection (for AUO test only. Do not connect)
28	VDD	Power +5V
29	VDD	Power +5V
30	VDD	Power +5V

Note 1: Input signals of odd and even clock shall be the same timing.

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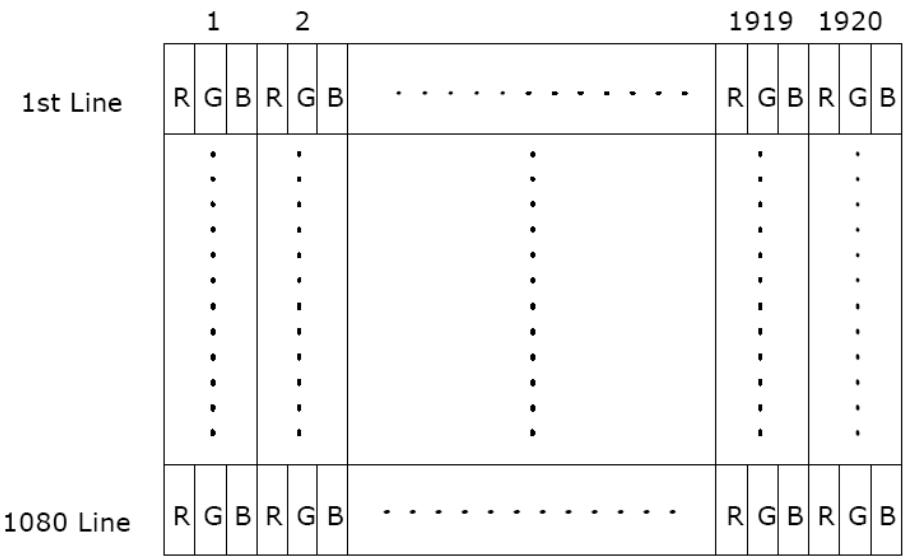
文件名称	LCD Module Specification 液晶模组规格书	页次	13 / 26
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COLOR DATA INPUT ASSIGNMENT

Data Input Format

Pixel Format Definition

Following figure shows the relationship of the input signals and LCD pixel format.



4.4 Back-light Interface Connection

Connector type		Symbol	Feature
Name	Pin No		
CN1	1	LED+	Positive of LED String
	2	LED-	Negative of LED String

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5. INTERFACE TIMING

5.1 INPUT SIGNAL TIMING SPECIFICATION

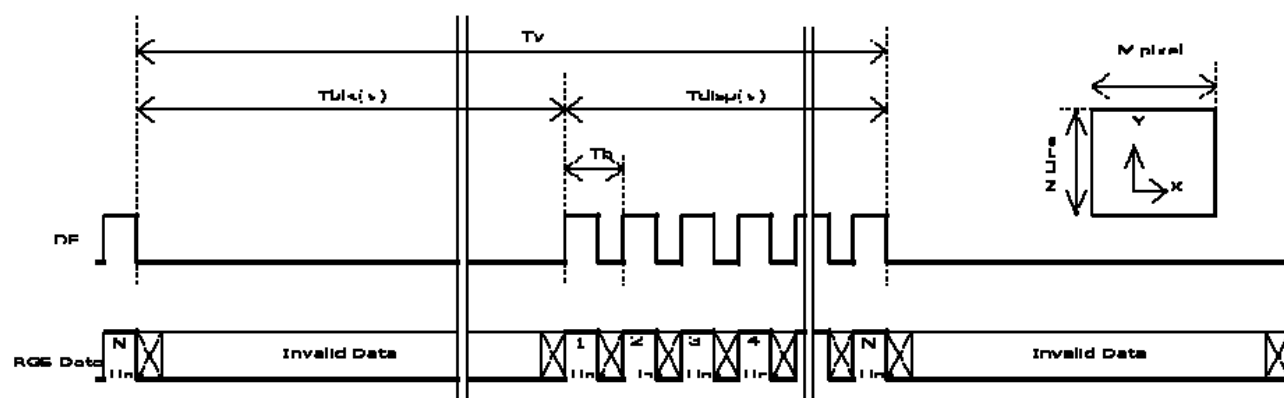
The input signal timing specifications are shown as the following table and timing diagram.

Basically, interface timing described here is not actual input timing of LCD module but close to output timing of SN75LVDS82DGG (Texas Instruments) or equivalent.

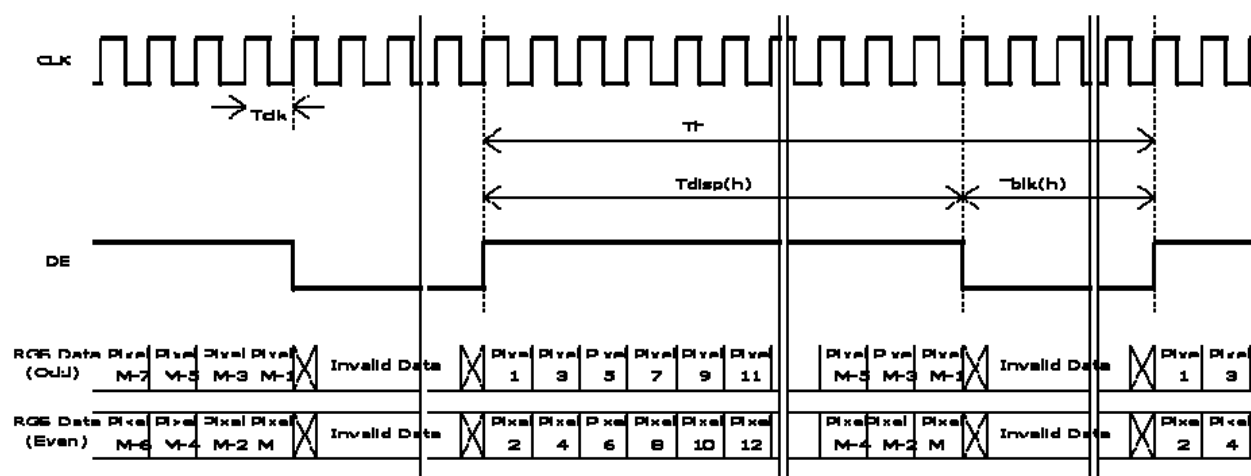
Signal	Item	Symbol	Min	Typ	Max	Unit
Vertical Section	Period	T_v	1092	1130	1818	Th
	Active	$T_{disp}(v)$	1080	1080	1080	Th
	Blanking	$T_{bp}(v)+T_{fp}(v)+PW_{vs}$	12	50	738	Th
Horizontal Section	Period	T_h	1034	1050	1100	Tclk
	Active	$T_{disp}(h)$	960	960	960	Tclk
	Blanking	$T_{bp}(h)+T_{fp}(h)+PW_{hs}$	74	90	140	Tclk
Clock	Period	Tclk	10.6	14.0	17.7	ns
	Frequency	Freq	56.5	71.2	94.0	MHz
Frame rate	Frame rate	F	50	60	76	Hz
Hsync Frequency	Hsync Frequency	HFreq	55	68	91	KHz

Note : DE mode only

Timing diagram

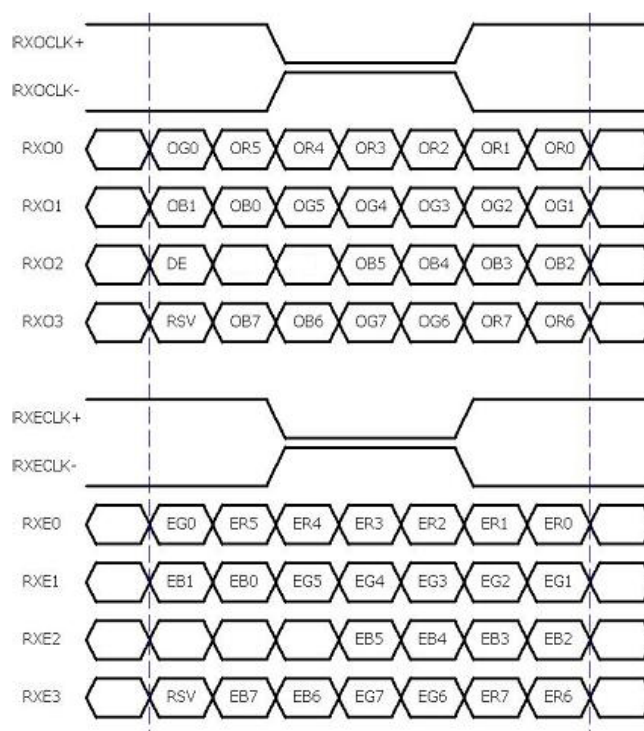


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5.2. LVDS RECEIVER INTERFACE TIMING DIAGRAM

The input data format



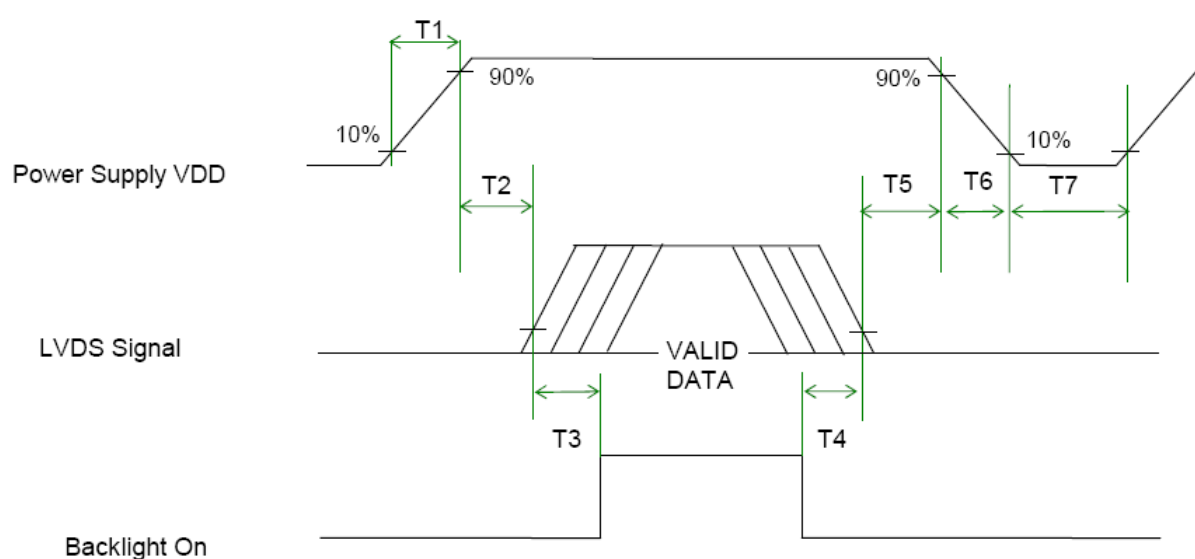
Note 1: R/G/B data 7:MSB, R/G/B data 0:LSB O = "First Pixel Data" E = "Second Pixel Data"

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5.3 POWER SEQUENCE

To prevent a latch-up or DC operation of the LCD module, the power on/off sequence shall be as shown in below

VDD power and backlight on/off sequence are as follows. Interface signals are also shown in the chart. Signals from any system shall be Hi-Z state or low level when VDD is off.



Parameter	Value			Unit
	Min.	Typ.	Max.	
T1	0.5	-	10	[ms]
T2	0	-	50	[ms]
T3	500	-	-	[ms]
T4	100	-	-	[ms]
T5	0		50	[ms] Note 1,2
T6	0	-	100	[ms] Note 1,2
T7	1000	-	-	[ms]

Note1 : Recommend setting T5 = 0ms to avoid electronic noise when VDD is off.

Note2 : During T5 and T6 period , please keep the level of input LVDS signals with Hi-Z state.

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6. OPTICAL CHARACTERISTICS

6.1 TEST CONDITIONS

item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	°C
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	Vcc	5.0	V
Input Signal	According to typical in "3.ELECTRICAL CHARACTERISTICS"		
Light Bar Input Voltage	VLED	23~27	VDC
Light Bar Input Current	ILED	390	mA DC (per string)
Duty	D	100	%

6.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown in 6.2. The following items should be measured under the test conditions described in 6.1 and stable environment shown in Note (6).

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Color Chromaticity (CIE 1931)	Red	R _x	$\theta_x=0^\circ, \theta_y=0^\circ$ Viewing Angle at Normal Direction	Typ - 0.03	0.644	Typ + 0.03	-	(1)
		R _y			0.336			
	Green	G _x			0.285			
		G _y			0.593			
	Blue	B _x			0.141			
		B _y			0.076			
	White	W _x			0.313			
		W _y			0.329			
	Color Gamut	CG		70	80		%	(1)
	—Center Luminance of White (Center of Screen)			L _c	180	250		cd/m ²
Contrast Ratio		CR	700	1000	-	-	(1)、(2)	
Response Time		T _R	-	1.5	2.5	ms	(1)、(3)	
		T _F		3.5	5.5			
White Variation		ΔW	-	-	1.33	-	(4)、(5)	
Viewing Angle	Horizontal	θ +x	CR ≧10	160	170	-	Deg.	(1)、(3)
		θ -x		160	170	-		
	Vertical	θ +Y		140	160	-		
		θ -Y		140	160	-		

Note (1) Definition of Viewing Angle (θ_x, θ_y):

Viewing angles are measured by BM-7A

Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

Contrast Ratio (CR) = L₂₅₅ / L₀

L₂₅₅: Luminance of gray level 255

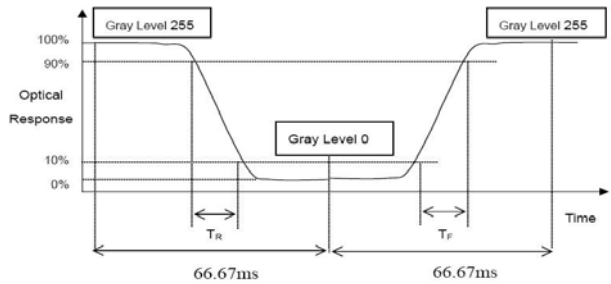
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L 0: Luminance of gray level 0

CR = CR (5)

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (7).

Note (3) Definition of gray to gray switching time:



The driving signal means the signal of luminance 0%, 20%, 40%, 60%, 80%, 100%.

Gray to gray average time means the average switching time of luminance 0%, 20%, 40%, 60%, 80%, 100% to each other.

Note (4) Definition of Luminance of White (L_C , L_{AVE}):

Measure the luminance of gray level 255 at center point

$$L_C = L(5)$$

$$L_{AVE} = [L(1) + L(2) + L(3) + L(4) + L(5) + L(6) + L(7) + L(8) + L(9)] / 9$$

L (x) is corresponding to the luminance of the point X at Figure in Note (7).

Note (5) Measurement Setup:

The LCD module should be stabilize for (30 minutes) to avoid abrupt temperature change during measuing.

In order to stabilize the luminance ,the measurement should be executed after lighting Backlight for (30 minutes) in a windless room.

Note (6) Definition of white variation()

Measure the luminance of gray level 255 at 9 points

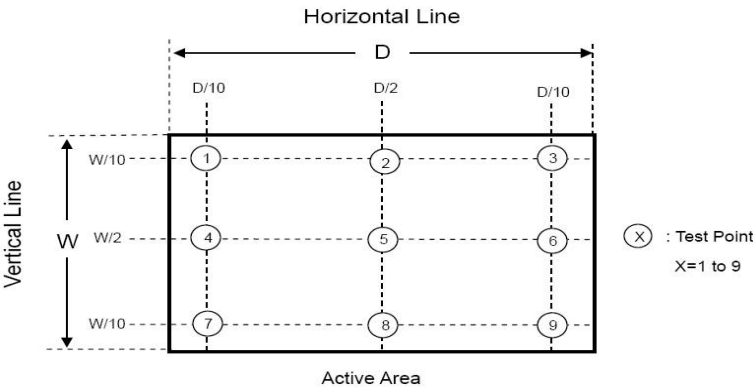
Measurement Setup:

The LCD module should be stabilized at given temperature for 30min to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 30min in a windless room.

Note (7) Definition of White Variation (δW):

Measure the luminance of gray level 255 at 9 points

$$\delta W = \text{Maximum } [L(1), L(2), L(3), L(4), L(5) \dots L(9)] / \text{Minimum } [L(1), L(2), L(3), L(4), L(5) \dots L(9)]$$



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7.INTERNATIONAL STANDARD

7.1 SAFETY

- (1) UL1950 Third Edition, Underwriters Laboratories, Inc. Jan. 28, 1995 Standard for Safety of Information Technology Equipment Including electrical Business Equipment.
- (2) CAN/CSA C22.2 No. 950-95/60950 Third Edition, Canadian Standards Association, Standard for Safety of Information Technology Equipment Including Electrical Business Equipment.
- (3) EN60950 : 1992+A2: 1993+A2: 1993+C3: 1995+A4: 1997+A11: 1997 IEC 950: 1991+A1: 1992+A2: 1993+C3: 1995+A4:1996

European Committee for Electrotechnical Standardization (CENELEC) EUROPEAN STANDARD for Safety of Information Technology Equipment Including Electrical Business Equipment.

7.2 EMC

- (a) ANSI C63.4 "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electrical Equipment in the Range of 9kHz to 40GHz. "American National standards Institute(ANSI), 1992.
- (b) C.I.S.P.R "Limits and Methods of Measurement of Radio Interface Characteristics of Information Technology Equipment." International Special committee on Radio Interference.
- (c) EN 55022 "Limits and Methods of Measurement of Radio Interface Characteristics of Information Technology Equipment." European Committee for Electrotechnical Standardization. (CENELEC), 1998

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8. RELIABILITY

Environment test items and its conditions are listed as following table.

No	Test Items	Conditions	
1	High temperature storage test	Ta = 60 °C, 240 hrs	
2	Low temperature storage test	Ta = -20 °C, 240 hrs	
3	High temperature & high humidity operation test	Ta = 50 °C, 80%RH, 240hrs	
4	High temperature operation test	Ta = 50 °C, 240hrs	
5	Low temperature operation test	Ta = 0 °C, 240hrs	
6	Thermal shock	Ta = -20 °C ↔ 60 °C (0.5 hr), 100 cycle	
7	Vibration test (non-operating)	Frequency	10 ~ 300 Hz, Sweep rate 30 min
		Gravity / AMP	1.5 G
		Period	±X, ±Y, ±Z 30 min
8	Shock test (non-operating)	Gravity	50G
		Pulse width	11msec, sine wave
		Direction	±X, ±Y, ±Z Once for each
9	Electro-static discharge test (non-operating)	Air : 150 pF, 330 Ω, 15 KV Contact : 150 pF, 330 Ω, 8 KV	

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10. PRECAUTIONS

MOUNTING PRECAUTIONS

- (1) You must mount a module using holes arranged in four corners or four sides.
- (2) You should consider the mounting structure so that uneven force (ex. twisted stress) is not applied to module. And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the module.
- (3) Please attach the surface transparent protective plate to the surface in order to protect the polarizer. Transparent protective plate should have sufficient strength in order to resist external force.
- (4) You should adopt radiation structure to satisfy the temperature specification.
- (5) Acetic acid type and chlorine type materials for the cover case are not desirable because the former generates corrosive gas of attacking the polarizer at high temperature and the latter cause's circuits break by electro-chemical reaction.
- (6) Do not touch, push or rub the exposed polarizer with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment. Do not touch the surface of polarizer for bare hand or greasy cloth. (Some cosmetics are detrimental to the polarizer.)
- (7) When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks with petroleum benzene. Normal-hexane is recommended for cleaning the adhesives used to attach front/ rear polarizer. Do not use acetone, toluene and alcohol because they cause chemical damage to the polarizer.
- (8) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
- (9) Do not open the case because inside circuits do not have sufficient strength.

OPERATING PRECAUTIONS

- (1) The spike noise causes the mis-operation of circuits. It should be lower than following voltage: $V=\pm 200\text{mV}$ (Over and under shoot voltage)
- (2) Brightness depends on the temperature. (In lower temperature, it becomes lower.) And in lower temperature, response time (required time that brightness is stable after turned on) becomes longer.
- (3) Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
- (4) When fixed patterns are displayed for a long time, remnant image is likely to occur.
- (5) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimize the interface.

ELECTROSTATIC DISCHARGE CONTROL

Since a module is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wrist band etc. And don't touch interface pin directly.

PRECAUTIONS FOR STRONG LIGHT EXPOSURE

Strong light exposure causes degradation of polarizer and color filter.

STORAGE

When storing modules as spares for a long time, the following precautions are necessary.

- (1) Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5°C and 35°C at normal humidity.
- (2) The polarizer surface should not come in contact with any other object. It is recommended that they be stored in the

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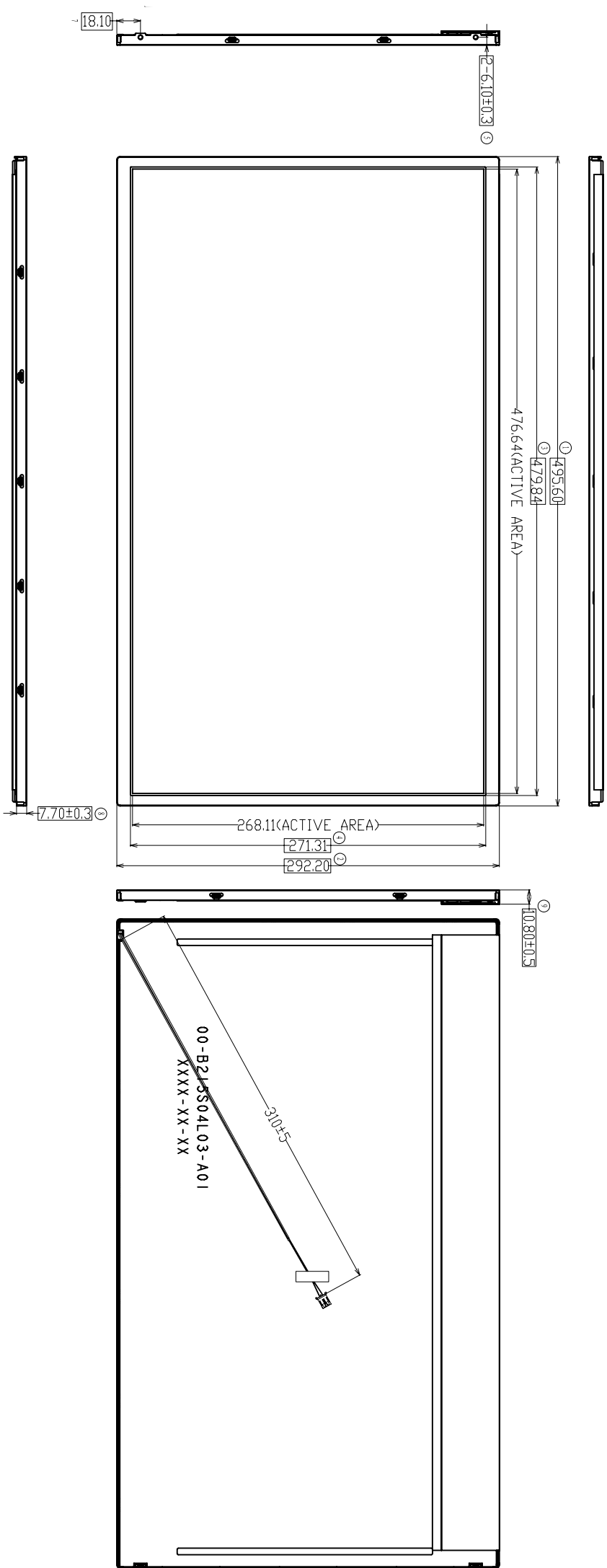
文件名称	LCD Module Specification 液晶模组规格书	页次	22 / 26
产品名称	T215S23-L03 LED 液晶模组	版次	1.0

container in which they were shipped.

HANDLING PRECAUTIONS FOR PROTECTION FILM

- (1) The protection film is attached to the bezel with a small masking tape. When the protection film is peeled off, static electricity is generated between the film and polarizer. This should be peeled off slowly and carefully by people who are electrically grounded and with well ion-blown equipment or in such a condition, etc. When the module with protection film attached is stored for a long time, sometimes there remains a very small amount of glue still on the bezel after the protection film is peeled off.
- (2) You can remove the glue easily. When the glue remains on the bezel or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with normal-hexane.

11. Mechanical Outline

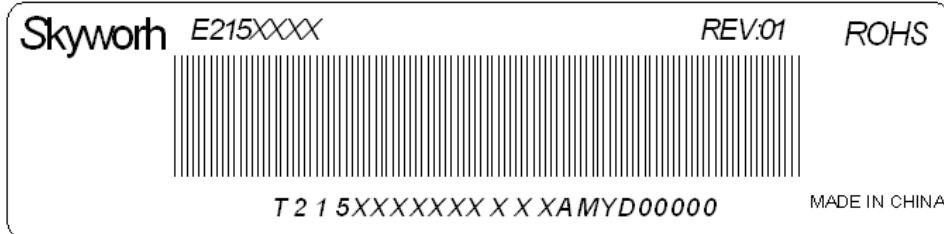


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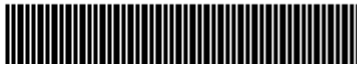
文件名称	LCD Module Specification 液晶模组规格书	页次	23 / 26
产品名称	T215S23-L03 LED 液晶模组	版次	1.0

12.Packaging:

12.1. Moudle lable



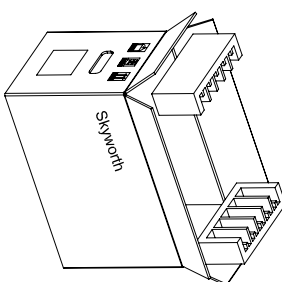
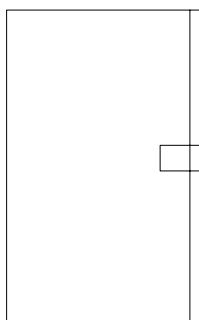
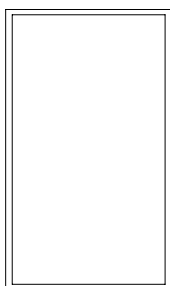
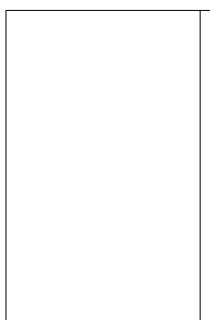
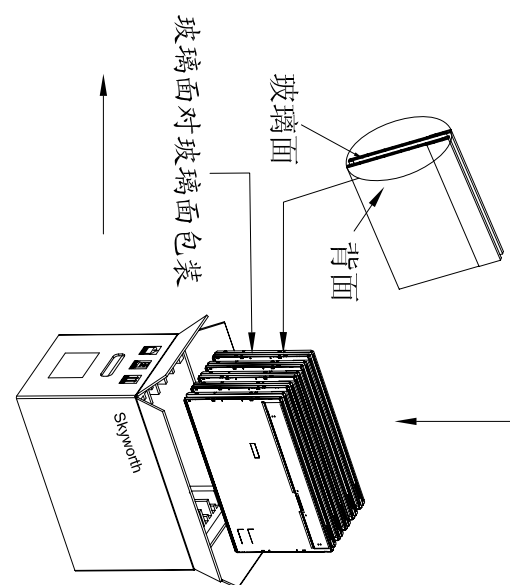
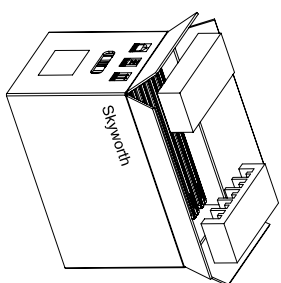
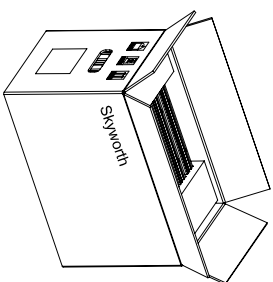
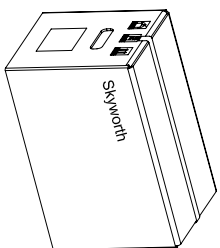
- (1) LCM with PE bags, 7PCS/BOX, A pallet loaded a total of forty five of the eight-box case
- (2) Carton size: 550.5mm*255mm*355mm
- (3) Carton labels, Figure:

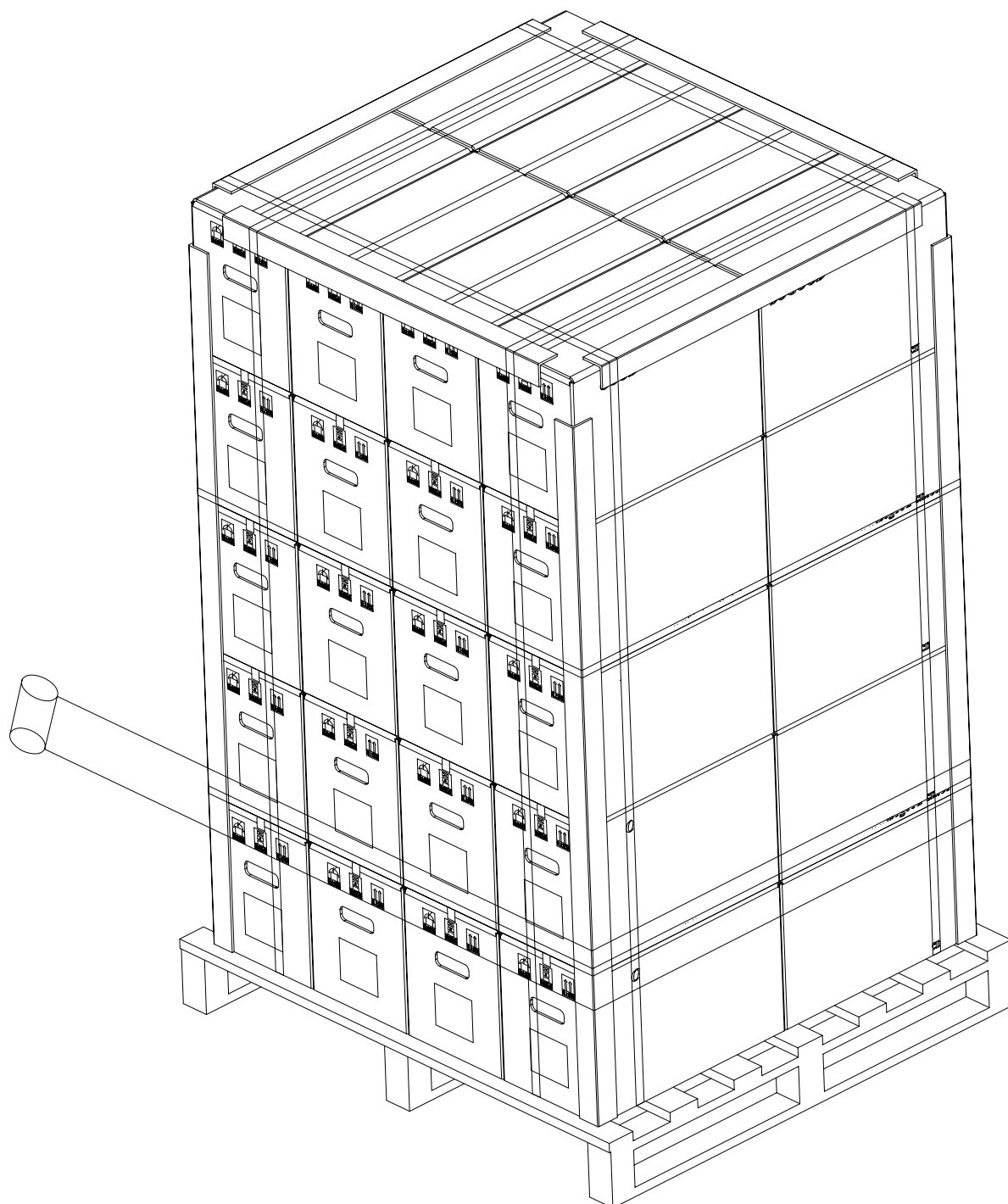
Skyworth		液晶模组事业部	
		 L01XXXX AMYD00000	
品名			
客户			
订单号		 ROHS	
内部料号			
内部品名			
数量			
生产日期			

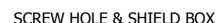
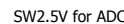
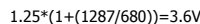
12.2. Packing:

- (1) 7PCS module glass surface of each relative load box, Diagram, as in packaging
- (2) Carton pallet placement diagram of the light package
- (3) PP belt: W13M*0.6MMM
- (4) Corner Protector A: 1500*50*50mm
- (5) Corner Protector B: 840*50*50mm
- (6) Film: W450mm*T0.05mm
- (7) Pallet: 1150*1050*140mm

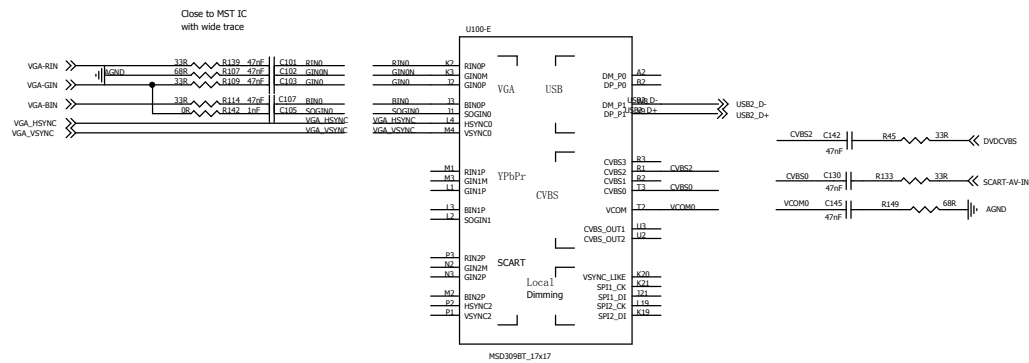
Note: The packaging must meet the packaging requirements



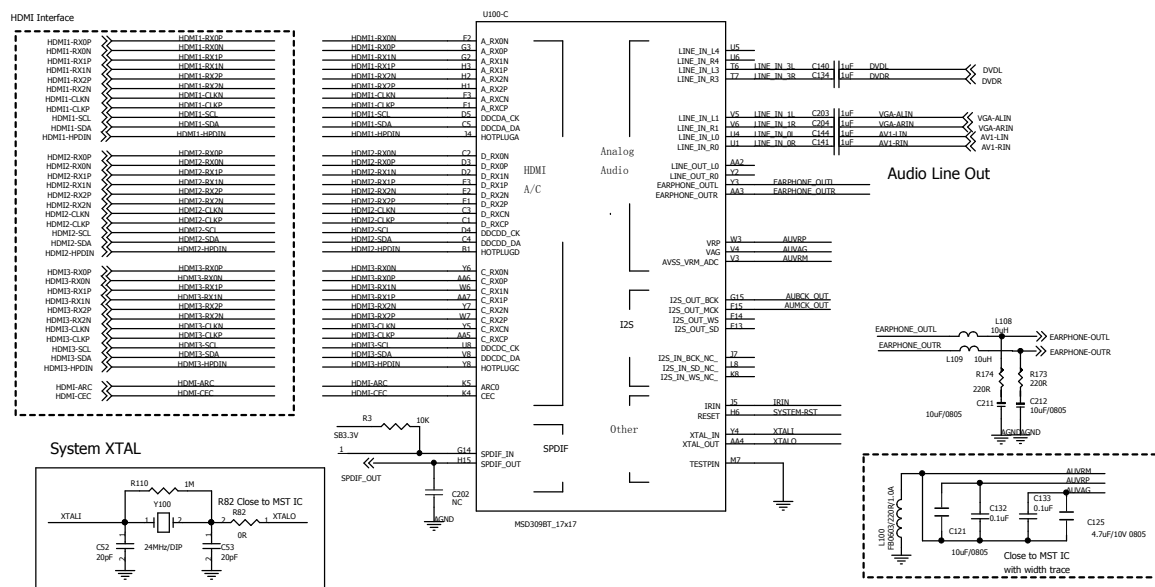




RGB & CVBS & USB



HDMI & Audio

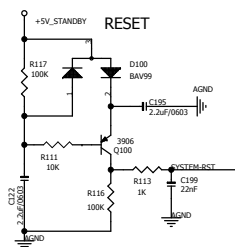
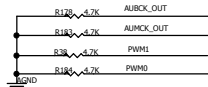


Mode Selection

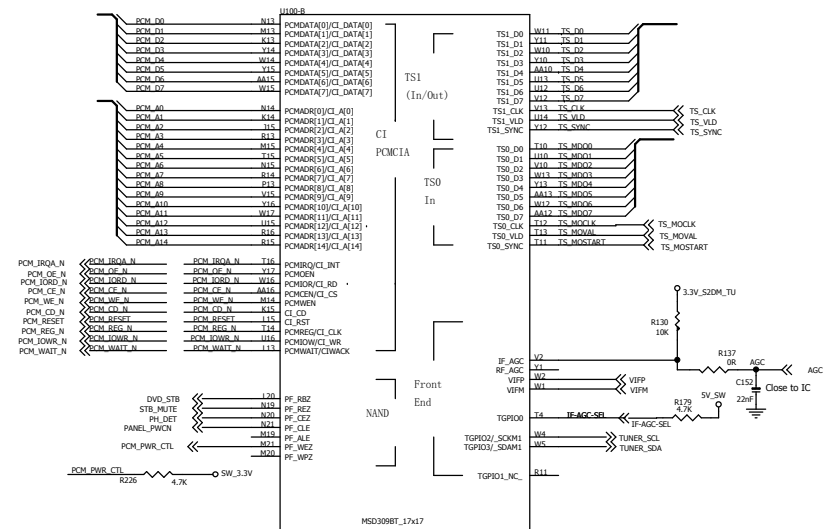
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// CHIP Config (I2S_OUT_BCK, I2S_OUT_MCK, PAD_PWM1, PAD_PWM0)
BS1_NO_EJ    4'b0000    Boot from BS01 with SPI flash
BS1_NO_WS    4'b0001    Secure BS1 without scramble
BS1_WS       4'b0010    Secure BS1 with scramble

MIPS_SPI_NO_EJ 4'b0100    Boot from MIPS with SPI flash
MIPS_SPI_EJ_1  4'b0101    Boot from MIPS with SPI flash
MIPS_SPI_EJ_2  4'b0110    Boot from MIPS with SPI flash

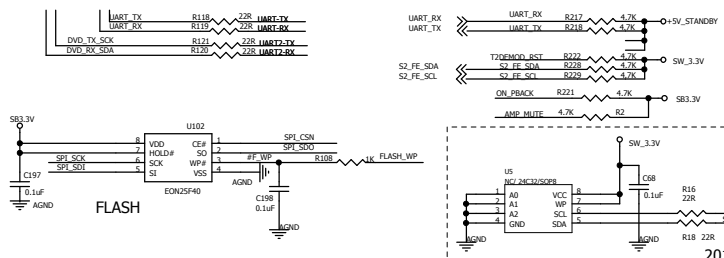
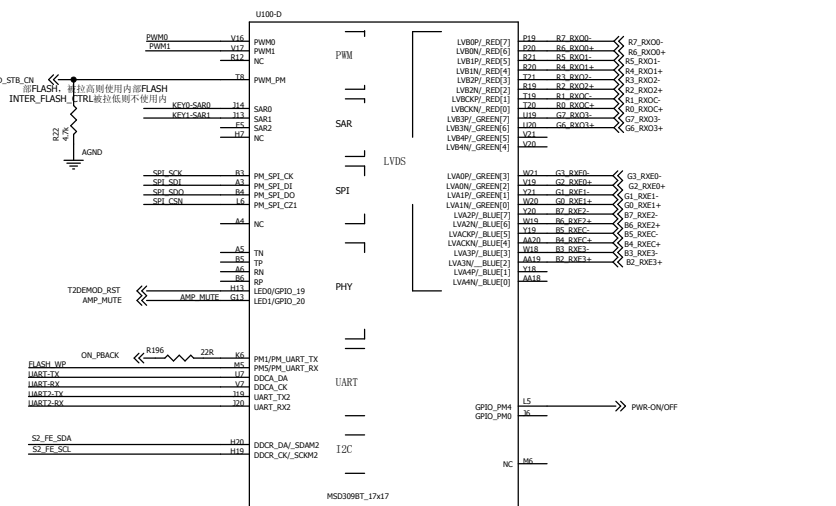
MIPS_WOS       4'b0011    Secure MIPS without scramble
MIPS_WS        4'b0110    Secure MIPS with scramble
SBUS           4'b0111
```



CI & TS & Front End

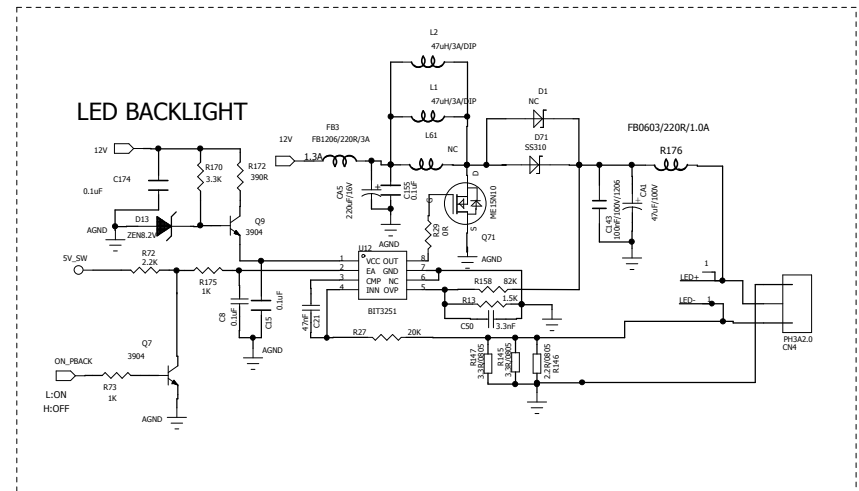
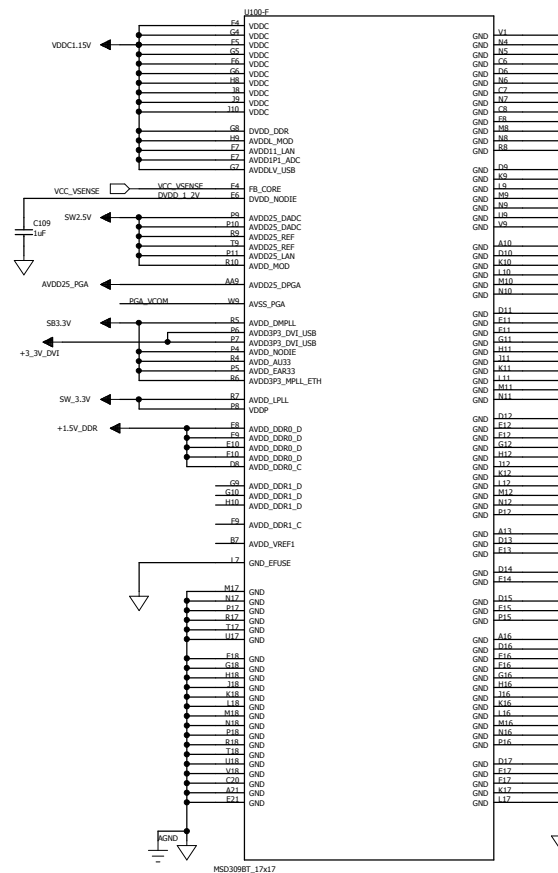
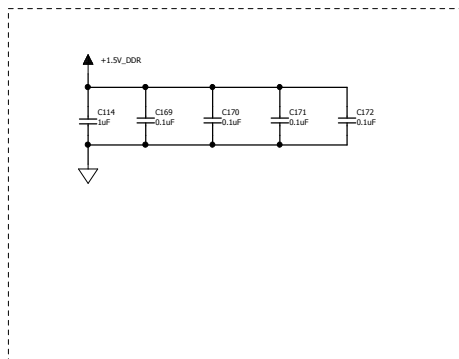
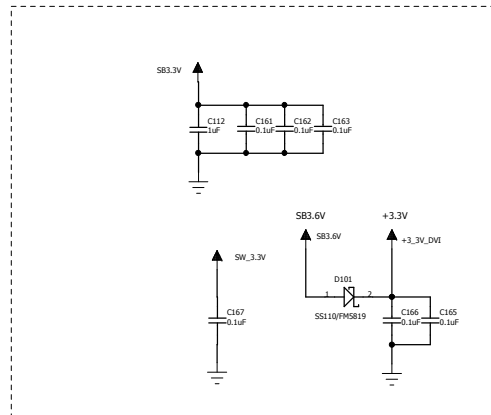
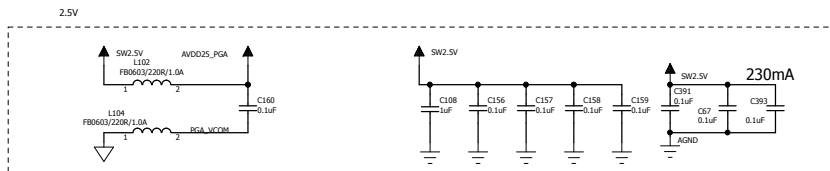
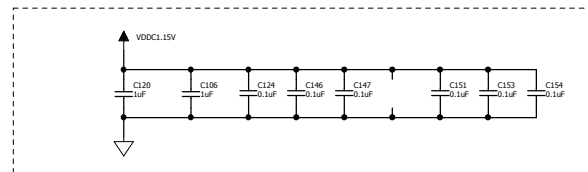


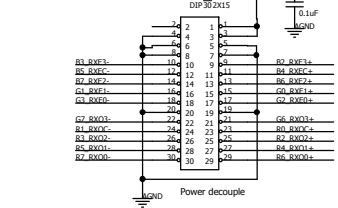
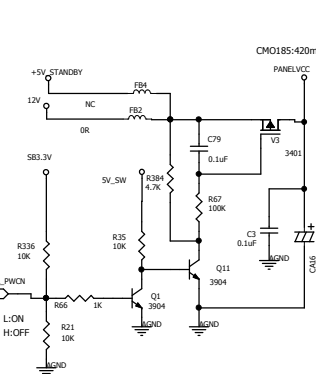
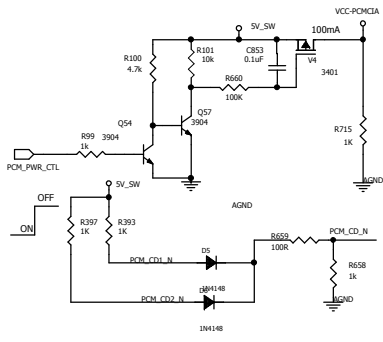
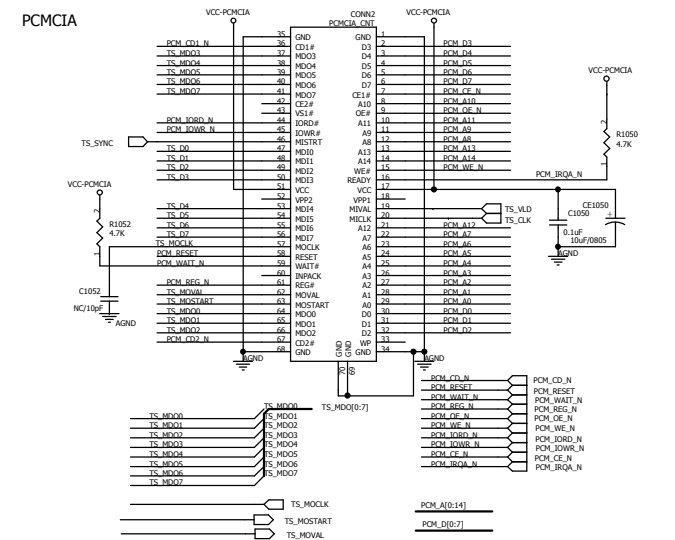
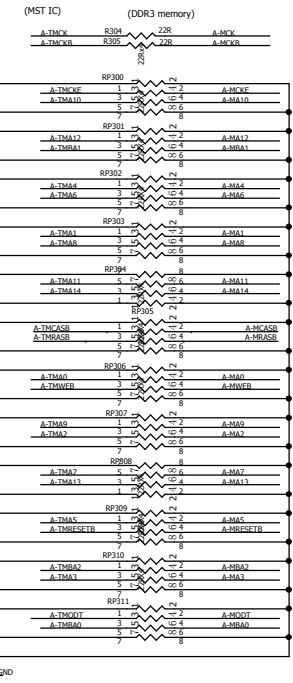
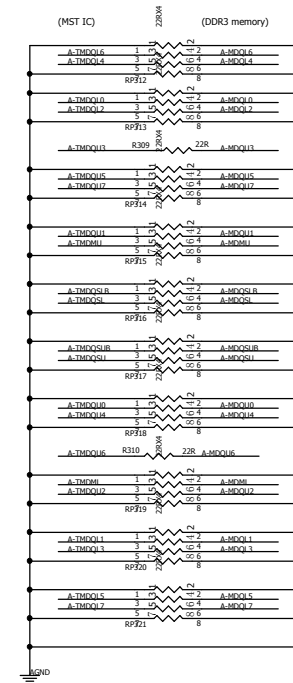
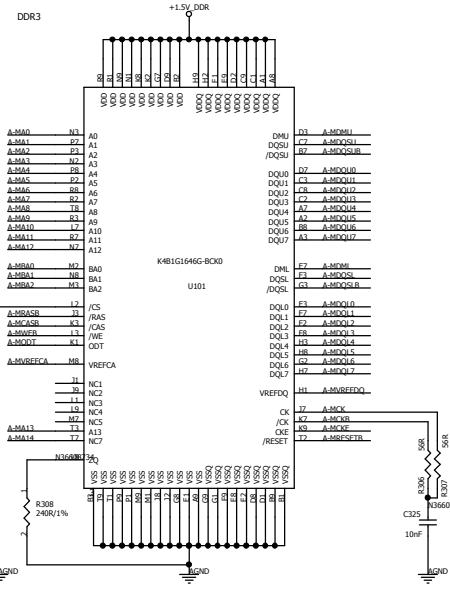
GPIO & LVDS



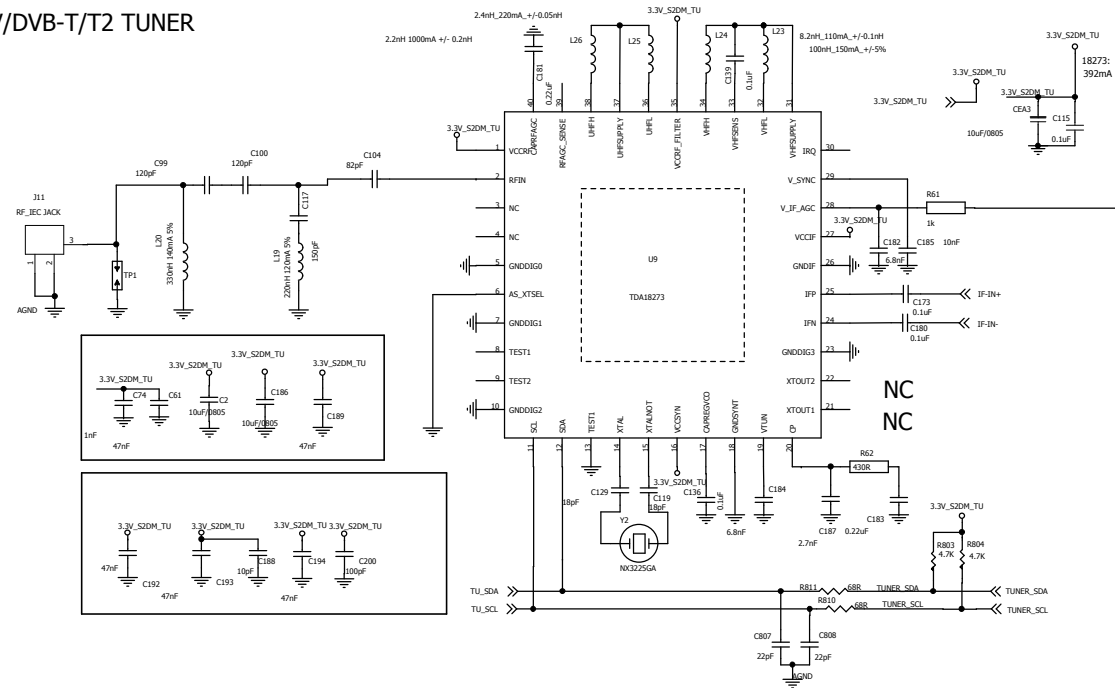
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MSD39BT Power interface

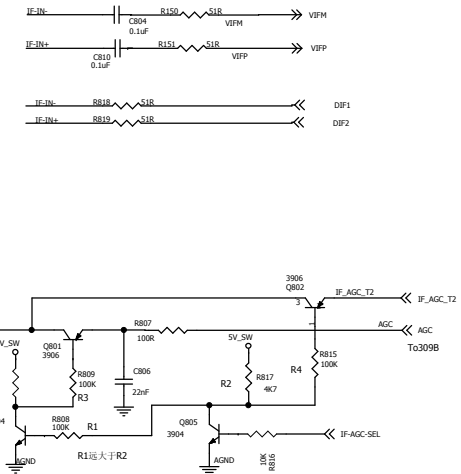




ATV/DVB-T/T2 TUNER



Tuner Connector



DVB-T2 Demodulator

