

TV Productor Service Manual

DATE: 2014-03-13

YOUR COMPANY NAME:

YOUR MODEL NAME:

Production & Function Description:

Action: CVMV29L-F-10

Function: VGA+YPbPr+ AV+ ATV +Audio IN+HDMI

TV System: PAL+SECAM+NTSC

Approved Signatures:

Approved By Customer Project Leader	Reviewed By Project Leader	Issued By D.C.C.

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1. Basic Function & Specifications -----	3
2. Maintenance & Safety -----	4
3. Software Upgrade -----	4
4. mainboard Specifications -----	5-24
5. mainboard schematic diagram-----	25-32
6. mainboard service manual-----	33-44
7. Power Board service manual-----	45-61
8. Panel Specifications-----	62-

. Basic Specifications

Working Temp: 0~40℃

Storage Temp: -20~60℃

Humidity (Working): 10~90%

Humidity (Store): 10~90%

CCFL Lifespan (50 Lum, Tube current < Rating): 60000 hour (II=4.5Ma 25℃)

MTBF:50000 hour (Panel Module NOT included)

Power requirement: Voltage 100~240 V 50 / 60 Hz

(Note: The above specifications are suitable for most of the TV models, and for your reference only.)

2. Maintenance & Safety

2.1 Safety Warning:

- (1) The inside key components in the LCD must be offered and replaced by qualified and appointed manufacturer. Otherwise it may generate electricshocks, fires or other important unsafety cases.
- (2) Don't try to change the circuits without authorized permission.
- (3) Ensure to study the maintenance and service manual thoroughly before doing any of the maintaining actions.

2.2 High Voltage Warning:

Please be highly noted the high voltages in the circuit.

2.3 Electricshocks and Fires Warning:

- *Connect the insulate transformer between the AC current to the LCD before repairing the panel.
- *Take care of the Soldering Pad related to the high voltage circuit. When there occurs short-circuit case, please replace the overheated components in time.
- *All protective equipments must be re-installed according to the original design.

*Check the rosin joints, stack welds and the insulations, ensure there is no objection attached.

2.4 Antistatic Warning:

- *The inner circuit boards in the LCD TV are sensitive to the statics. Please take care of the ESD protection when replace the circuit boards.
- *The circuit boards must be packed by antistatic bags.
- *Please wear antistatic ring and gloves when during repairing works.

2.5 Attention:

LVDSVDD – if the LCD is in 5V, it must be switched to the setting of 5V. And if the LCD is in 3.3V, it must be switched to the setting of 3.3V. (Switch setting: **CN6** -- 5V or 3.3V)

3. Instruments

3.1 Multimeter:

Max Input Current : over 1A / Max Input Voltage : 500Vdc
Measurement Range : 10Mv~100Vdc / Accuracy : 0.03%

3.2 Oscilloscope

Frequency Band : over 20M /Input Impedance : over 1M
Input Capacitance : below 30pF / Max Input Voltage : 250V

3.3 PC: XGA (1024X768@60Hz)

3.4 HD Singal Generator: 480P 576P 720P 1080i@50/60HZ

3.5 DVD Player: Audio/Video output, S-VIDEO output, HDMI output.

3.6 VGA cable, S-VIDEObable, RCA cable, YpbPr cable and HDMI cable.

3.7 Chip test: 18.5" or 24" LCD, power board, panel cable, INVERTER cable,

3.8 Control board, Receiver, Remote controller.

3.9 Color TV Pattern Generator: FLUK 54200.

3.10 Work equipment will need Anti static searing-iron, tweezer,wire cutter,soldring tin, rosin,brush

4. Software Upgrade

The chip inside the LCD is designed with a FLASH ROM memory program: it can be erased

and reprogrammed, it can be also updated via the USB port or VGA port. The program is related to the chip fucntion ---Different functions of chips need to be planted with different versions of prgrams.

Please upgrade the new software by the USB port the instruction steps below:

-----Please copy the new software to the USB

-----Power ON the TV and press MENU to display the main menu ,then press / to the

OPTION menu. And then select the software in the root of your USB memory , Press ENTER .then press◀ to update and ▶ to cancel.

Remarks: When the first upgrading is finished, the action of turning on the tv will be a little slow. So when you turn on the TV at the first time, you need to press the "power" key on the remote control several times until you turn on the tv. Turning on the TV at the first time is very important, you need to operate it carefully to avoid the upgrading is not successful.



REV: V1.0

LCD TV CONTROL BOARD SPECIFICATION

MODEL : CVMV29L-F-10

AUTHOR :

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PUBLISHED DATE: Mar. 25, 2013

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ITEM

1.	CHANGE THE LIST OF UPGRADES	2
2.	GENERAL DESCRIPTION	3
3.	FEATURES	4
4.	PRESET MODE FOR USB	5
5.	ELECTRICAL CHARACTERISTICS	7
6.	SUBSTITUTABLE PRIMARY MATERIALS	8
7.	PICTURES	10
8.	INTERFACE DEFINITION	13
9.	CONFIGURATION	16
10.	APPLICATION REQUIREMENT	19
11.	EXCURSUS	20

1. CHANGE THE LIST OF UPGRADES

Version	Description	Page	redaction	Checked	Date
V1.0	First Release	All	YJ.Hao		Mar.25, 2013

2. GENERAL DESCRIPTION

This product is analogue TV board, it can receive the PAL/SECAM/NTSC analogue television signals.

Chipset **TSUMV29** and **TSUMV59** are pin to pin.

With chipset **TSUMV29**, USB slot can only used for updating software.

With chipset **TSUMV59**, USB slot can be used for updating software and play multimedia.

- Supports USB 2.0 multimedia play, supports audio and video play; supports text and picture browse.**(Only for TSUMV59)**
- Analogue and digital HD port input signal largest supports 1080P.
- The largest supports various TFT-LCD 1920x1080 resolutions module.
- 一、The HDMI supports 1.4, the HDCP supports 1.1.
- 3-D video decoding and Chroma separation.**(Only for TSUMV59)**
- 3-D motion adaptive video de-interlaces with edge-oriented adaptive algorithm for smooth low-angle edges.**(Only for TSUMV59)**
- 3-D video noise reduction.**(Only for TSUMV59)**
- Supports analogue 1000 Pages Teletext , Max storage 200 channels.
- Supports A2/NICAM/B/G/D/K/I/M/N demodulation in PAL/SECAM/NTSC.
- Automatic 3:2 pull-down & 2:2 pull-down detection and recovery.
- MStar 5rd Generation Advanced Color Engine (MStarACE-5) automatic picture enhancement.
- Reliable EMC and ESD handle.
- True color OSD, humanized operation menu, supports Channel List, channel edit and other deluxe function.

3. FEATURES

PANEL	Type	TFT-LCD/LED
	Resolution	Max. 1920X1080
	Interface	Single/ Double LVDS
ATV	Receiving range	49MHz – 863MHz
	Input Impedance	75Ω
	Video System	PAL ,SECAM ,NTSC
	Sound System	BG, DK, I, M/N NICAM/A2
PC	Sync	H: 30-75KHz V: 56-75Hz
	Video Level	0.7Vp-p@75ohm
	MODE	Max 1920X1080@60Hz
AV	Color system	PAL/NTSC/SECAM
	Video Level	1Vp-p@75ohm
	Audio Level	500mV rms
YPbPr	Video Level	Y:1Vp-p@75ohm, PbPr:0.7Vp-p@75ohm
	Audio Level	500mVrms
	Format	480i, 480p, 576i, 576p, 720p, 1080i, 1080p
HDMI	Video	Standard TMDS
	Format	480i, 480p, 576i, 576p, 720p, 1080i, 1080p
SCART	Video	CVBS&RGB input, CVBS output
	Video output/input	RBG: 0.7Vp-p@75ohm
		CVBS: 1Vp-p@75ohm
	Audio output/input	500mVrms
Keyboard	Power/Menu/Source/ Up/ Down/ Left/ Right	
OSD Language	English/Chinese/French/German/Spanish/Italian	
Audio Amplifier	2 X3W @ 4ohm THD<10%	
Power input	+12V	
Standby	< 0.2W(Main Board Only)	

4. PRESET MODE FOR USB

USB FORMAT MODE

Media	File Exit.	Codec		Remark
		Video	Audio	
MOVIE	.avi	MJPEG	MP3, WMA, ,AAC MP2, PCM (AC3 Need license) (DTS Need license)	The Max Resolution And Frame Rate: 640X480@30fps Max Data Rate: 10 Mbps
		Xvid,MPEG-2,MPEG-4, H.264, (Divx Need license)		The Max Resolution And Frame Rate: 1080p@30fps Max Data Rate: 20 Mbps
	.mp4	MPEG-2,MPEG-4,H,264 (Divx Need license)		
	.ts/ .trp	MPEG-2,H.264		
	.mpg	MPEG-1,MPEG-2		
	.mkv / .mov	MPEG-1/2/4,H.264, (Divx Need license)		
	.dat	MPEG-1	MP2 (AC3 Need license) (DTS Need license)	The Max Resolution:352×288 Max Data Rate: 20 Mbps
	.vob	MPEG-2		The Max Resolution:720×576 Max Data Rate: 20 Mbps
	.rm/ .rmvb	RV8,RV9, RV10	COOK	The Max Resolution And Frame Rate: 1080p@30fps Max Data Rate: 10 Mbps
PHOTO	.jpg	Progressive JPEG		Max Resolution: 1024×768
	.jpeg	Baseline JPEG		Max Resolution: 15360×8640
	.bmg	----		Max Resolution: 9600×6400 Pixel Depth: 1/4/8/16/24/32 bpp
	.png	Non-Interlaced		Max Resolution: 9600×6400
		Interlaced		Max Resolution: 1200×800
MUSIC	.mp3	---	MP3	Sample Rate:

	.wma	---	WMA	32K~48KHz Bit Rate: 32K~320Kbps Channel: Mono/Stereo
	.m4a / .aac	---	AAC	Sample Rate: 8K~48KHz Bit Rate: 24K~384Kbps Channel: Mono/Stereo
TEXT	.txt	ANSI/UNICODE GB/UTF8		File Size:Max 1MB

Note:

➤ This product includes the following optional patented technologies : **Dolby, DTS, DIVX, SRS** , etc. If you need to use these patented, please provide the patent license to us, so that the product can meet your requirements . (此产品包括如下可选的专利技术: **DOLBY、DTS、DIVX、SRS** 等, 如您需要开通这些功能, 请提前提供相关专利许可给到我司, 以便产品能满足您的要求。)

2) Support hard disk, the maximum storage capacity is **400G**

3) Folder in support of the greatest depth is **30**

5) Only support single audio channel audio format and dual-audio channel audio format

Operation Instructions

Hi Speed FS, FAT32, FAT16, NTFS(NTFS compressed file is not supported)

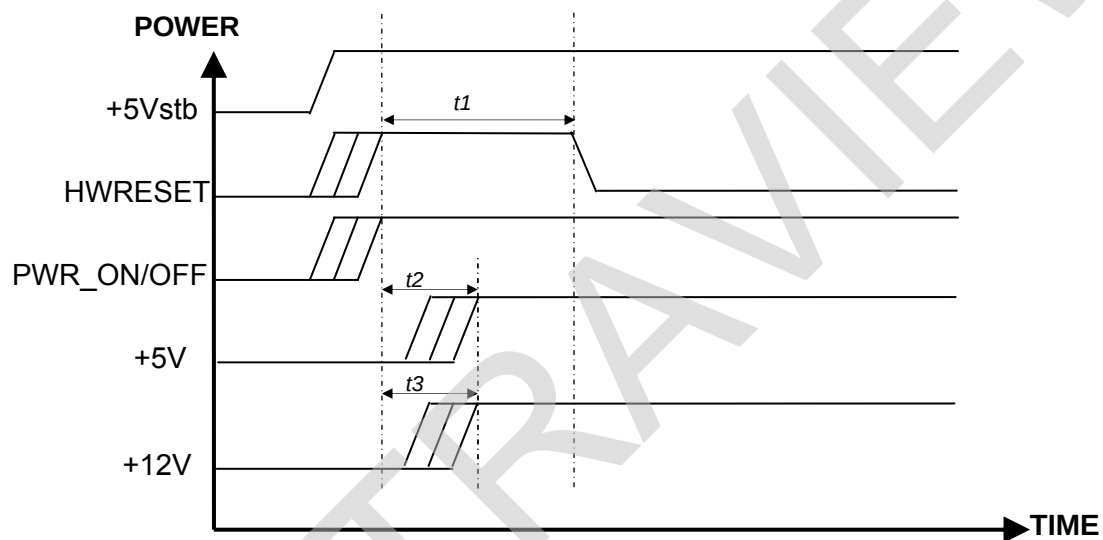
5. ELECTRICAL CHARACTERISTICS

Input Electrical Characteristics

Power	Symbol	Range	Max Current	Ripple
12V (Ext .Adaptor)	+12V	+12V--+12.5V	5A	100mV
12V (Built in)	+12V	+12V--+12.5V	2A	100mV

The current of panel, Inverter and extension modules are not included in max current.

Power Up Timing



alternation	DESCRIPTION	Min	Type	Max	Unit
$t1$	Hardware Reste Width	10	200	/	ms
$t2$	Pwr_on/off t_{setup} TO +5V t_{setup}	/	/	190	ms
$t3$	Pwr_on/off t_{setup} TO +12V t_{setup}	/	/	190	ms

6. SUBSTITUTABLE PRIMARY MATERIALS

General materials

Including SMT capacitors, SMT resistors, diodes, transistors, MOSFET, connectors, common inductance, electrolytic capacitor, PCB etc., and having no obvious changes in appearance or color. Our company has two or three alternative suppliers with these materials, maybe we will alternative use these materials for follow-up mass production due to delivery time, stock or other reasons. We no longer notice your company the alternative materials used. If necessary, you can apply for using related materials (mention as above) in samples stage.

(Note: The alternative materials which have been accepted by our materials confirmation department and PP will enter our system.)

Key materials

Including crystals, LDO, SAW Filter, DC-DC, Amplifier, Audio & Video switch, and having obvious changes in appearance and color of general materials, Our company has two or three alternative suppliers with these materials (See following table for detail), maybe we will alternative use these materials for follow-up mass production due to delivery time, stock or other reasons. We will notice your company the alternative materials used in written form. If necessary, you can apply for using related materials (mention as above) in samples stage.

Name	Main Type	Brand	Backup Type	Brand
LDO	BL1117	BL	BM1117	BM
DCDC	SY8120B	Silergy	BL8021	BL
	MP1495	MPS	--	--
Audio Amplifier	NS4263	NSIWAY	--	--
Crystal	24MHz +-20PPM	ZG	24MHz +-20PPM	LS
	20PF HC 49US		20PF HC 49US	TJ

Core materials

Including DDR, FLASH, TUNER, and the materials related to change software. Our company has two or three alternative suppliers with these materials (See following table for detail), maybe we will alternative use these materials for follow-up mass production due to delivery time, stock or other reasons. We will notice your company in written form and we must get your company confirm whether accept before using the alternative materials.

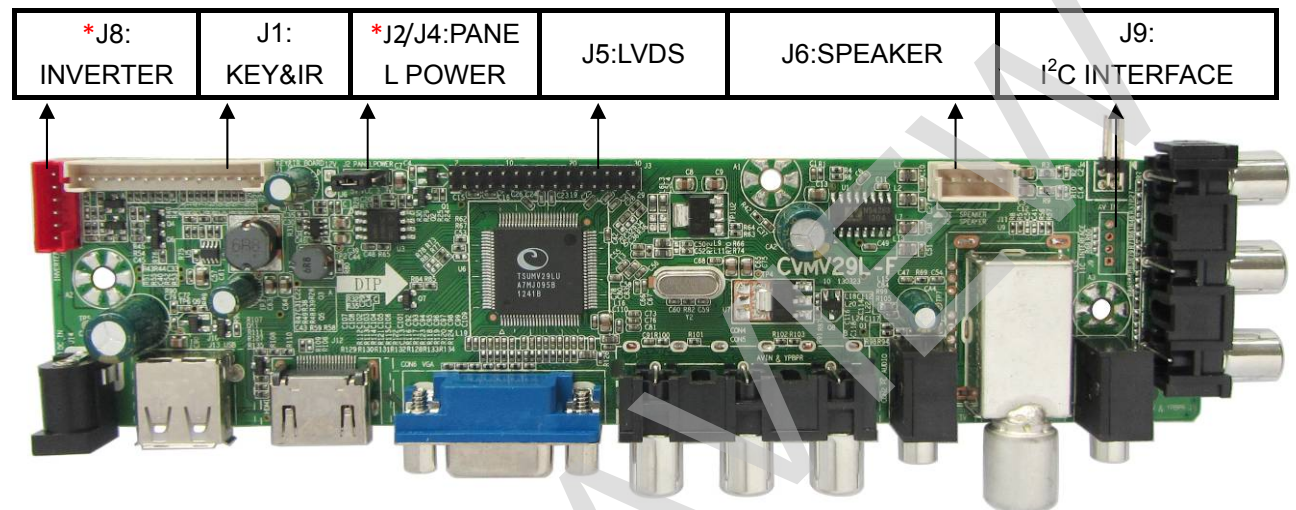
Name	Main Type	Brand	BackupType	Brand
Chipset	TSUMV59/TSUMV29	MSTAR	--	--
FLASH	W25Q32	WINBOND	GD25Q32BSIG	GD
			W25Q32BVSSIG	Winbond
			MX25L3206EM2I-12G	MXIC
			EN25Q32A	EON
			EN25Q32B	EON
	W25Q16CVSSIG	Winbond	GD25Q16BSIG	GD
			EN25Q16	EON
TUNER	R620D	Rafael	--	--
			--	--

7. PICTURES

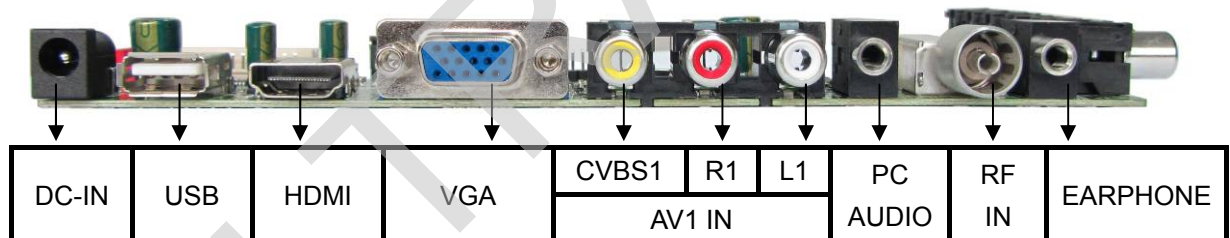
The picture is for a reference only,the actual item is the standard.

The optional connectors and terminals are marked with “*” .

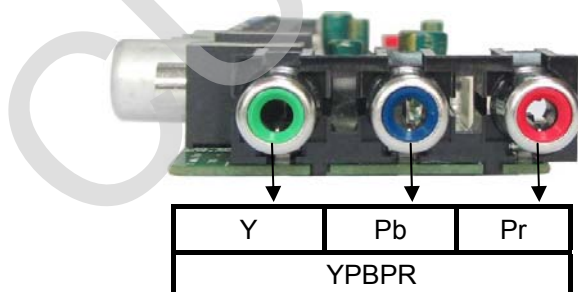
Board Type 1: TOP VIEW



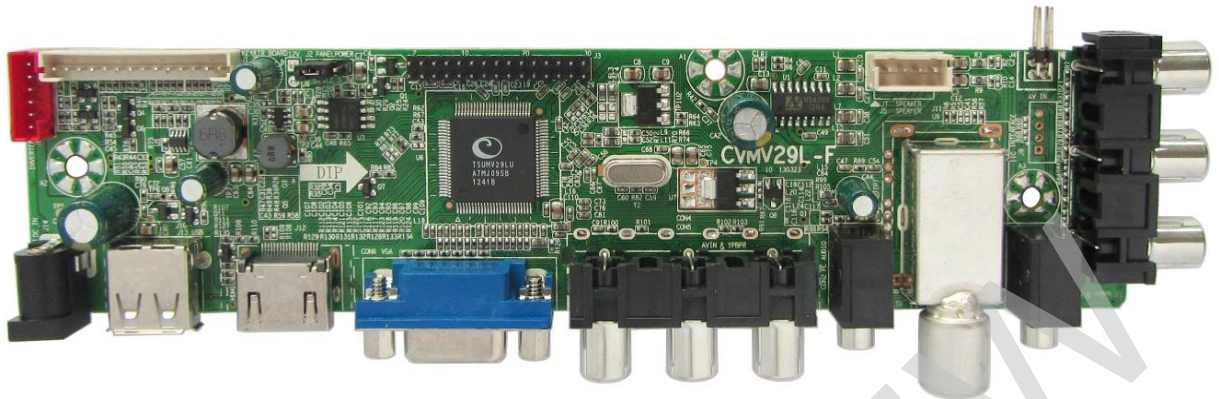
FRONT VIEW



SIDE VIEW



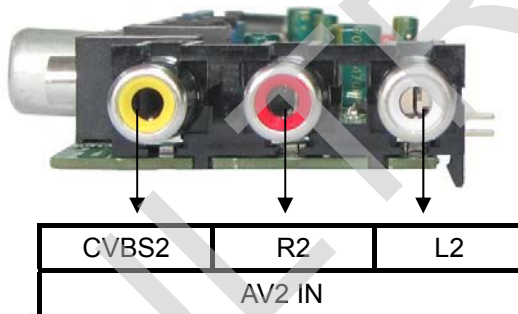
Board Type 2 :
TOP VIEW



FRONT VIEW

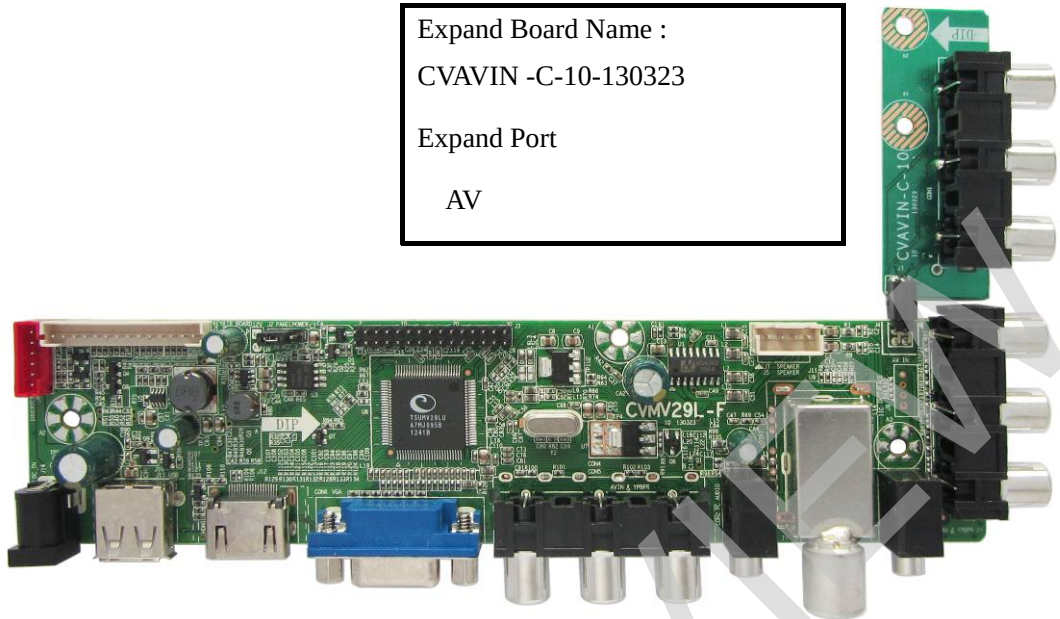


SIDE VIEW



Board Type 3 :
TOP VIEW

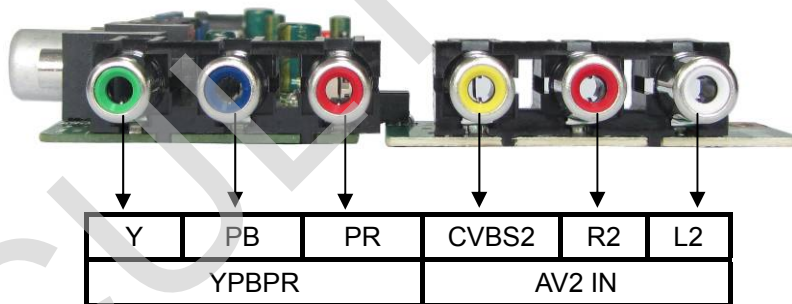
Expand Board Name :
CVAVIN -C-10-130323
Expand Port
AV



FRONT VIEW



SIDE VIEW



8. INTERFACE DEFINITION

All jacks recognize the square pad as first pin.

J1: KEY&IR BOARD CONNECTOR(14PIN/2.0)

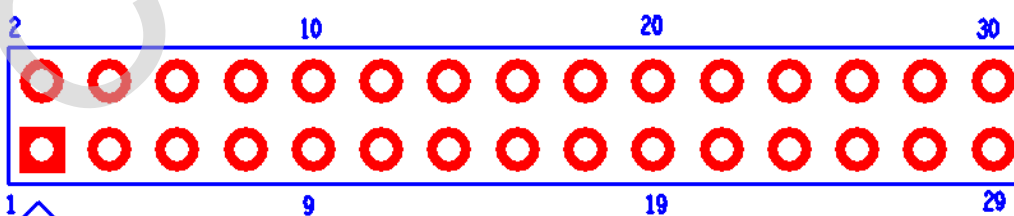
NO	Definition	Description
1	GND	Ground
2	K7	(Reserved)
3	K6	POWER key
4	K5	RIGHT key
5	K4	LEFT key
6	K3	SOURCE key
7	K2	UP key
8	K1	DOWEN key
9	K0	MENU key
10	GND	Ground
11	IR	Remote receive
12	LED_G	Green indicator
13	LED_R	Red indicator
14	LED_5V	+5V power

J2 : PANEL POWER SUPPLY(3PIN/2.54)



NO	Definition	Description
1	+3.3V	+3.3V panel voltage
2	VCC_PANEL	Panel Power In
3	+5V	+5V panel voltage

J3: LVDS INTERFACE(2×15PIN/2.0)



NO.	SYMBOL	DESCRIPTION
1	VCC	Power Supply For Panel
2	VCC	
3	VCC	
4	GND	Ground

5	GND	Ground
6	GND	Ground
7	RX00-	LVDS ODD 0- Signal
8	RX00+	LVDS ODD 0+ Signal
9	RX01-	LVDS ODD 1- Signal
10	RX01+	LVDS ODD 1+ Signal
11	RX02-	LVDS ODD 2- Signal
12	RX02+	LVDS ODD 2+ Signal
13	GND	Ground
14	GND	Ground
15	RXOC-	LVDS ODD Clock- Signal
16	RXOC+	LVDS ODD Clock + Signal
17	RX03-	LVDS ODD 3- Signal
18	RX03+	LVDS ODD 3+ Signal
19	RXE0-	LVDS EVEN 0- Signal
20	RXE0+	LVDS EVEN 0+ Signal
21	RXE1-	LVDS EVEN 1- Signal
22	RXE1+	LVDS EVEN 1+ Signal
23	RXE2-	LVDS EVEN 2- Signal
24	RXE2+	LVDS EVEN 2+ Signal
25	GND	Ground
26	GND	Ground
27	RXEC-	LVDS EVEN Clock- Signal
28	RXEC+	LVDS EVEN Clock + Signal
29	RXE3-	LVDS EVEN 3- Signal
30	RXE3+	LVDS EVEN 3+ Signal

J5 : SPEAKER CONNECTOR(4PIN/2.54)

NO.	SYMBOL	DESCRIPTION
1	ROUT+	Audio Right channel Output+
2	ROUT-	Audio Right channel Output-
3	LOUT-	Audio Left channel Output-
4	LOUT+	Audio Left channel Output+

J7: SPEAKER CONNECTOR(4PIN/2.0)

NO.	SYMBOL	DESCRIPTION
1	ROUT+	Audio Right channel Output+
2	ROUT-	Audio Right channel Output-
3	LOUT-	Audio Left channel Output-
4	LOUT+	Audio Left channel Output+

J8: INVERTER interfaces(6PIN/2.0)

NO	Definition	Description
----	------------	-------------

1	GND	Ground
2	GND	Ground
3	ADJ	Brightness Adjustment for Panel(Volts DC Output)
4	BL_ON	Back-Light ON/OFF Control for Panel
5	+12V	INVERTER +12V DC Power Supply
6	+12V	INVERTER +12V DC Power Supply

J9:EXTERNAL I²C CONNECYOR

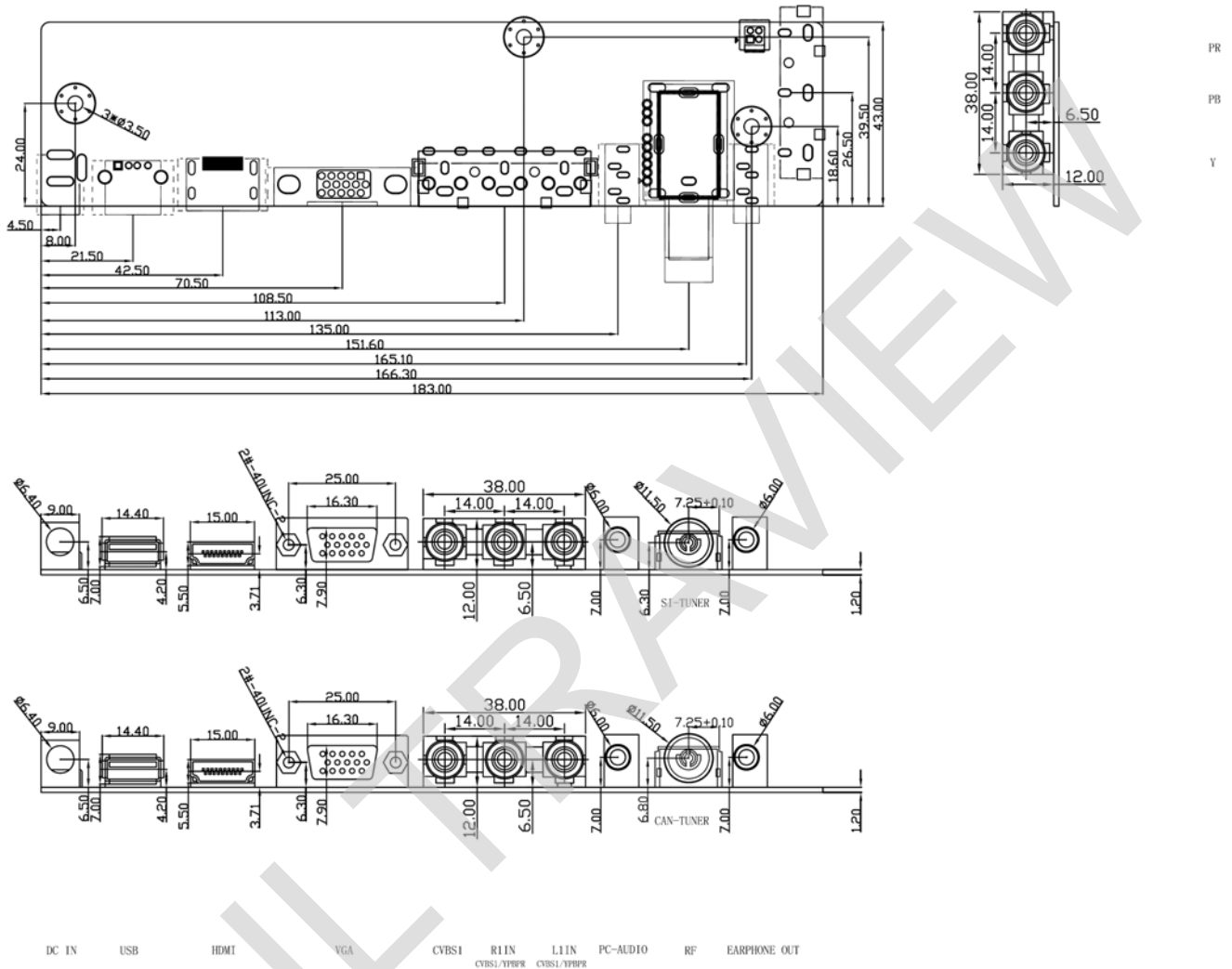
NO.	SYMBOL	DESCRIPTION
1	+5V	+5V DC Power Supply
2	SCL	External I ² C SCL
3	SDA	External I ² C SDA
4	GND	Ground

J10: EXTERNAL USB CONNECTOR(4PIN/2.0)

NO.	SYMBOL	DESCRIPTION
1	GND	Ground
2	DP	USB Data+
3	DM	USB Data-
4	+5V	+5V Power Supply for USB

9. CONFIGURATION

Board Type 1:



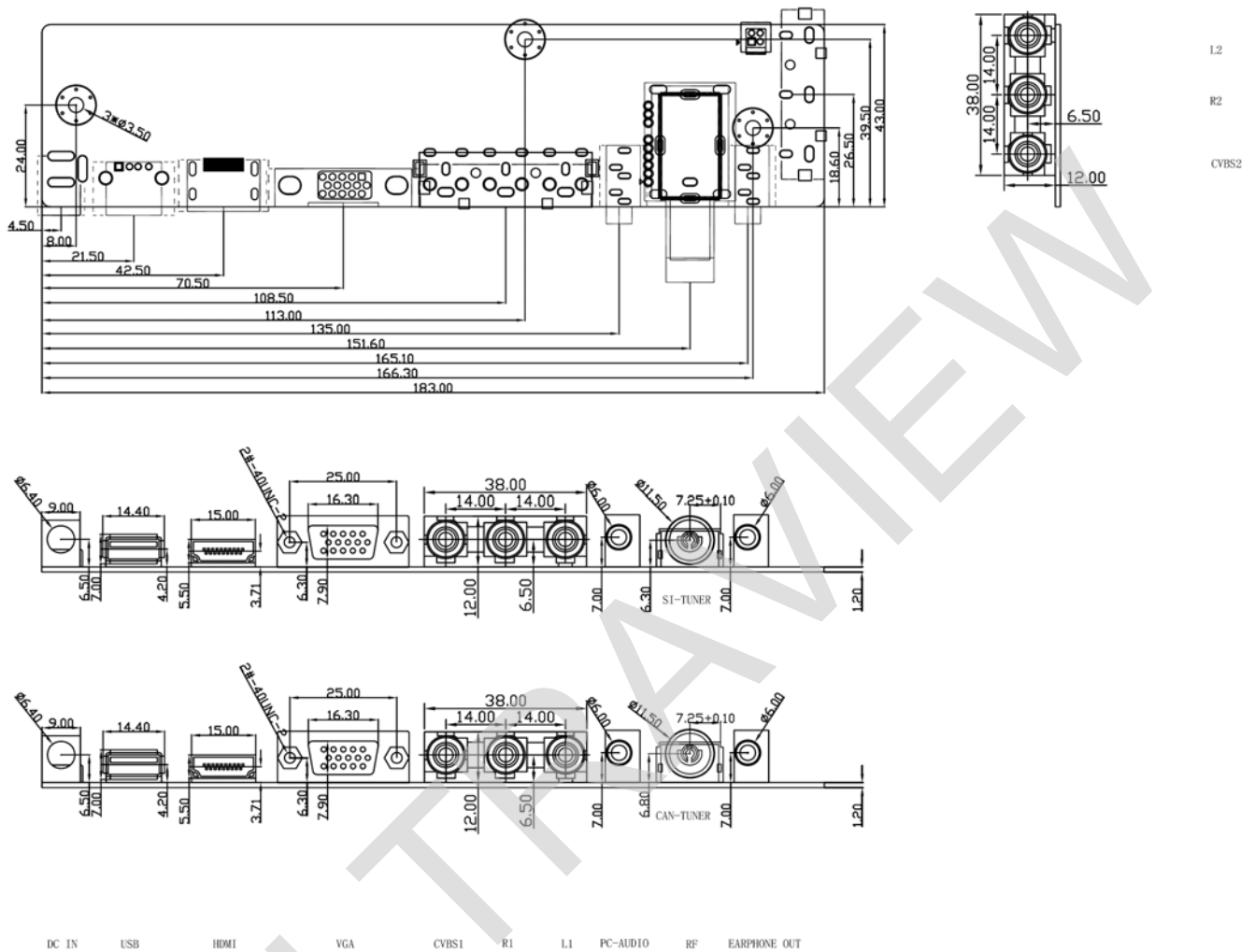
NTSC RF Connect is ϕ 9.5mm

The thickness of PCB board: 1.2 mm

Component the tallest altitude: 12.5 mm

Install diameter inside the bore 3.5 mm

Board Type 2 :



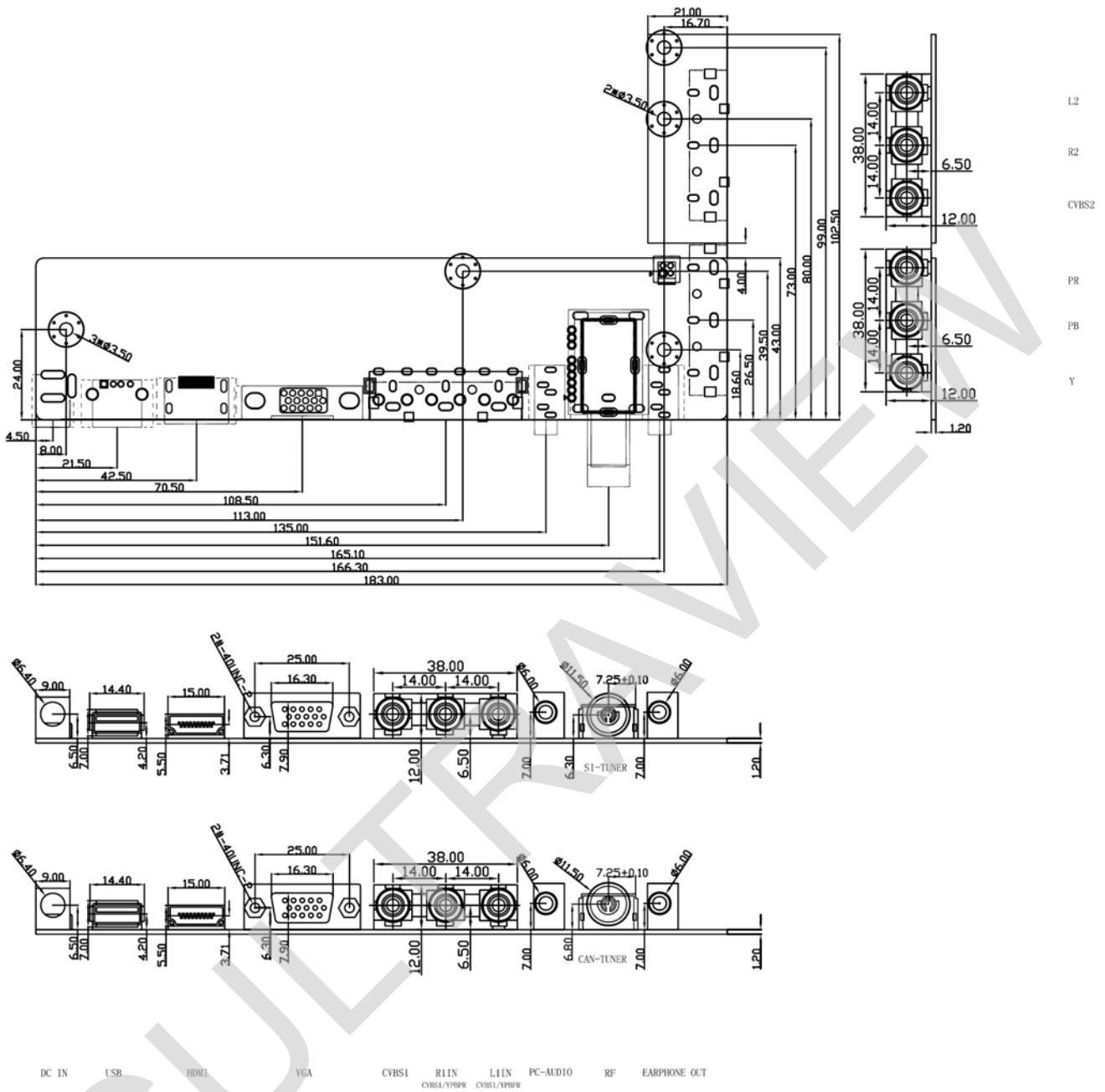
NTSC RF Connect is ϕ 9.5mm

The thickness of PCB board: 1.2 mm

Component the tallest altitude: 12.5 mm

Install diameter inside the bore 3.5 mm

Board Type 3:



NTSC RF Connect is ϕ 9.5mm

The thickness of PCB board: 1.2 mm

Component the tallest altitude: 12.5 mm

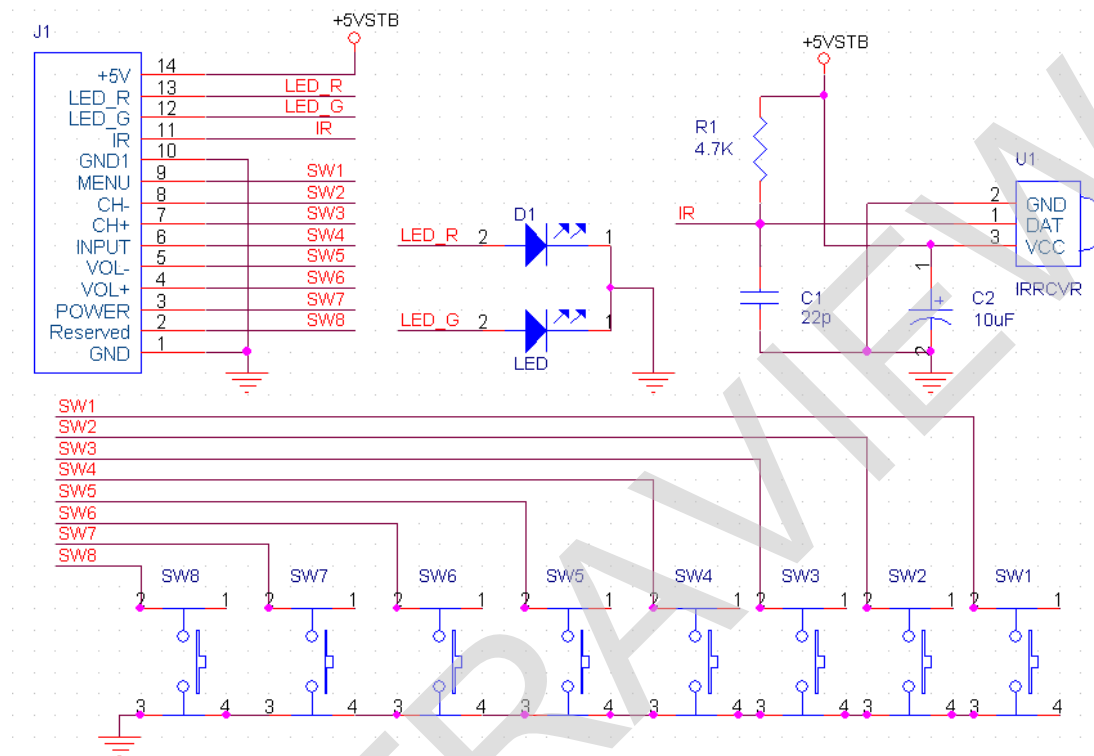
Install diameter inside the bore 3.5 mm

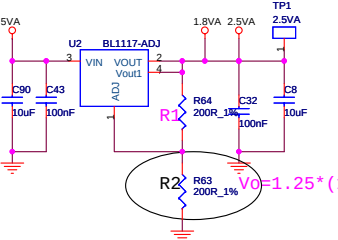
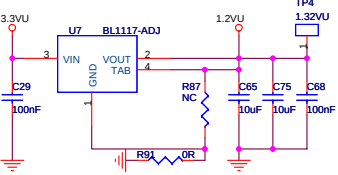
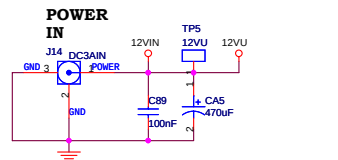
10. APPLICATION REQUIREMENT

- Relative humidity $\leq 80\%$
- Store temperature $-10\sim+60\text{ }^{\circ}\text{C}$
- Use temperature $0\sim+40\text{ }^{\circ}\text{C}$
- The procedure of the whole machine assembles and transports need to attend ESD transaction.
- When the whole set assemble, it can down pack or side pack, but don't make the board transform or distort, don't be subjected to heavy pressure.
- The hole of each port does not be opened too small, especially the HDMI port hole, avoid the whole set morphing to cause the extrusion of port when installing.
- The hole of RGB socket is recommended the situation of not using the screw stationary on the RGB socket to fix on the structure board.
- The connected wire which between the other boards and this board can't be leaded too long, or affect performance and image quality.
- The whole set inner wires matching reasonable, each connected wire try to not directly cross the PCB board, especially cross over from the main IC, avoid affect the whole set EMC performance.
- In order to obtain better EMC effect of the whole set, we suggest the LVDS twisted pair wire between the main board and panel must be tied up well and try to use shielding wire. If it's possible, try to put on the magnetic belt ring on the wire which near the board terminal.
- The HDMI and HDCP on the main board are all passed the related certifications, but we just provide testing certification of the inner usage standard. If you need to use legal HDMI and HDCP, please apply related association as formal member by yourself.
- There is ROHS identification on the board and package, the board match ROHS standard.

11. EXCURSUS

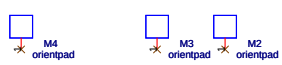
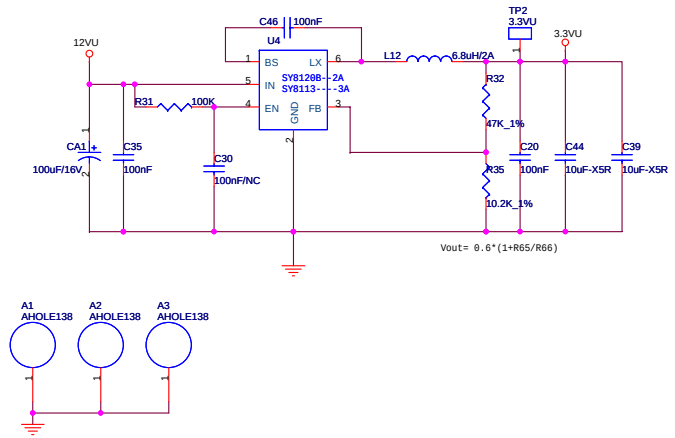
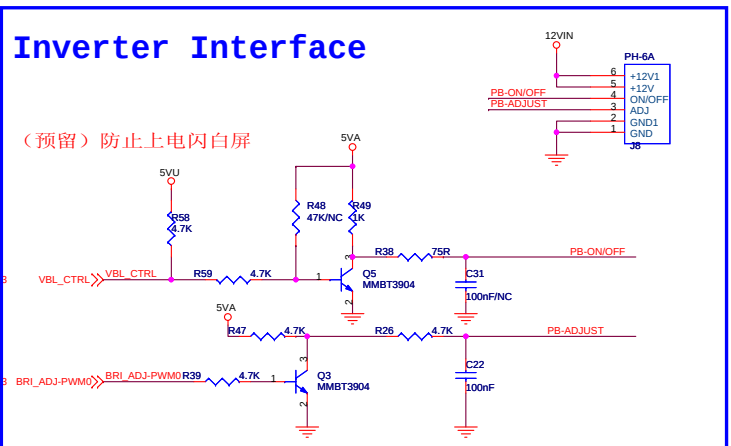
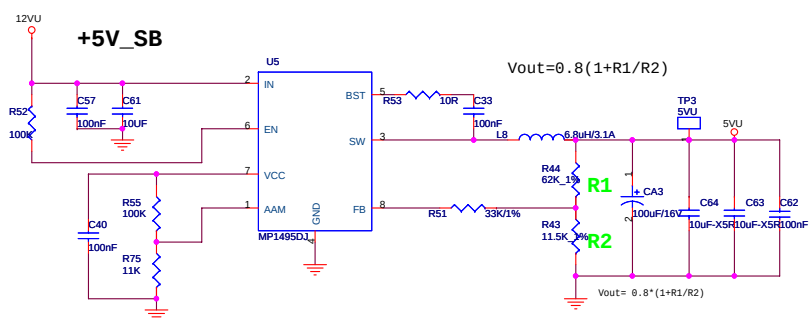
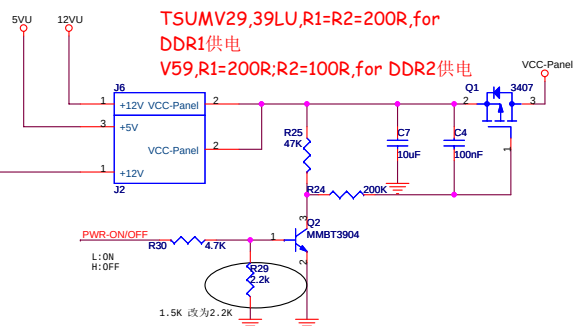
Keyboard and remote definition



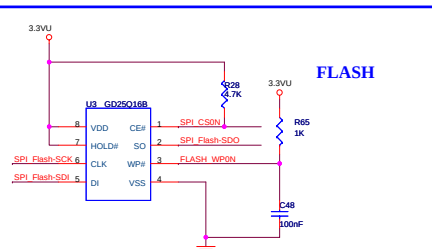
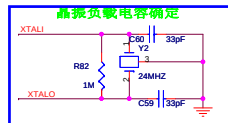
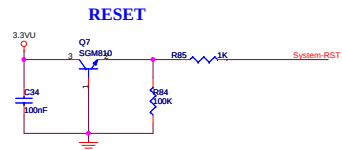


- 1、针对单12V输入的电，L27 ,L29 NC, L28装0R
- 2、针对单12V和5V同时长供的电，L27,L29 NC, L28装0R
- 3、针对12V和5V可控的内置电源，L27,L29 装0R, L28 NC, 注意5V转换电路和系统5V开关电路需要NC

SY8113改用MP1495

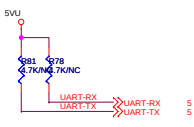


MAIN IC Chip

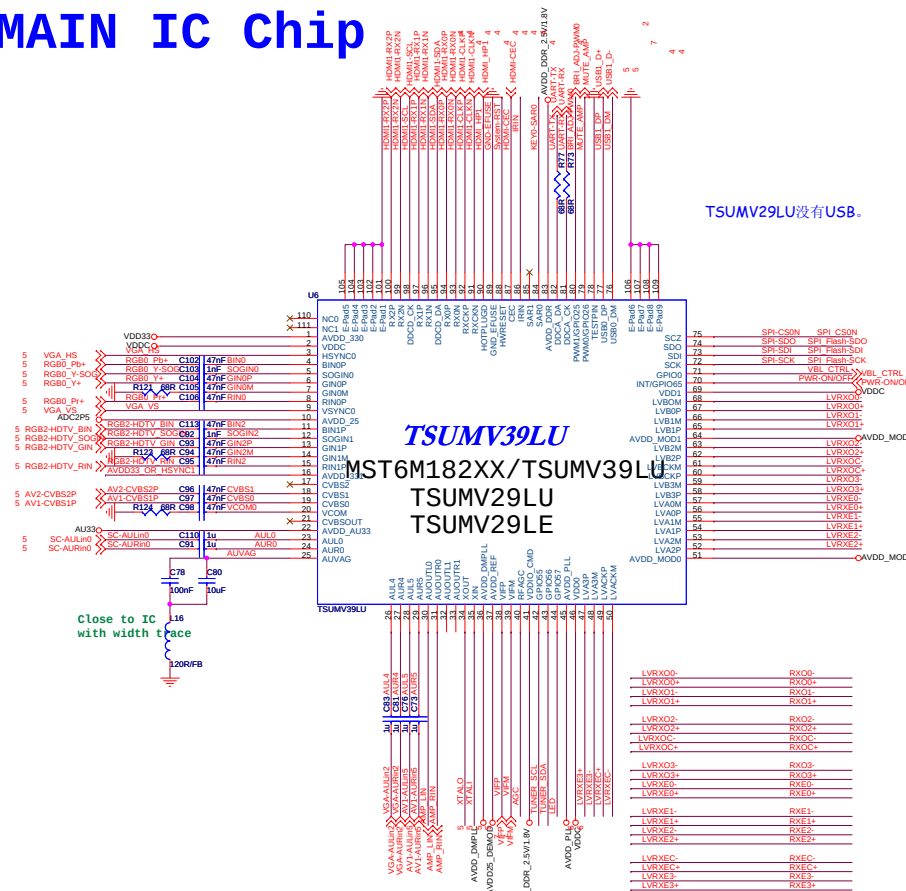
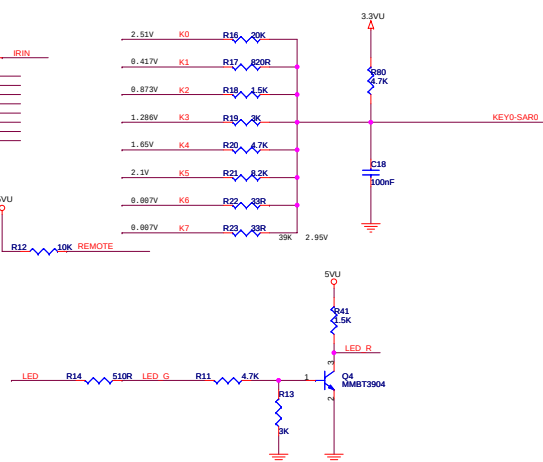
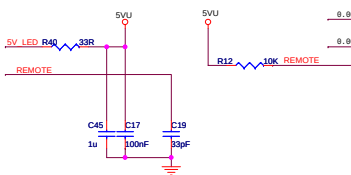
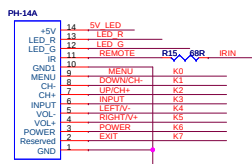


主IC选用TSMUMV39LU时，具有MM功能，默认使用1MByte的Flash，如果有需要，可以使用2MByte；如果不使用MM功能，则Flash默认为512K。

主IC选用TSMUMV29LU时，不具有MM功能，默认使用512KByte。

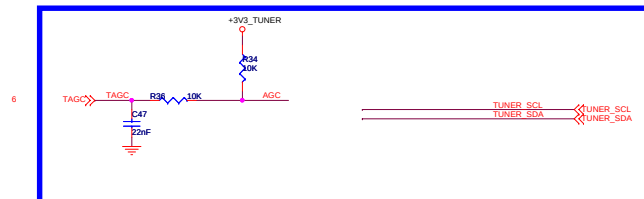


LED IR KEYBOARD



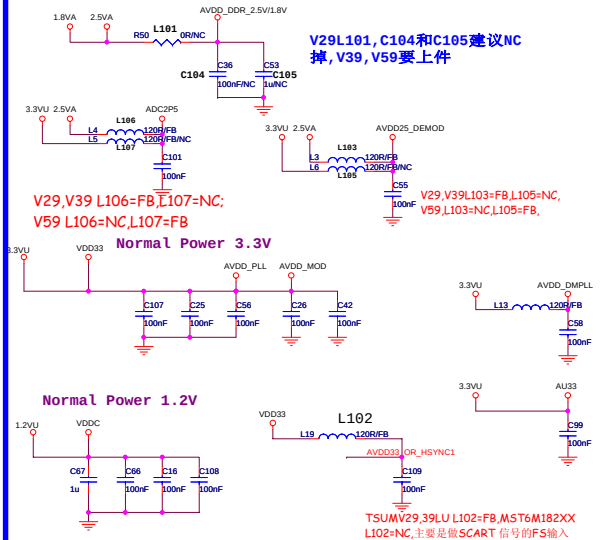
去掉排阻

Tuner Connector

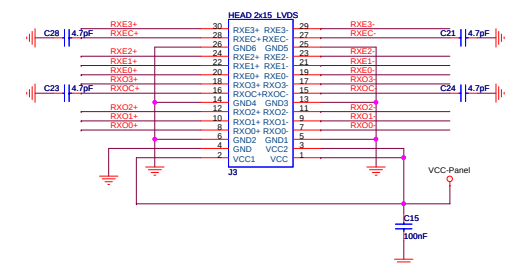
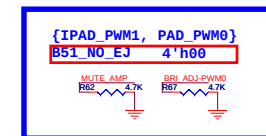


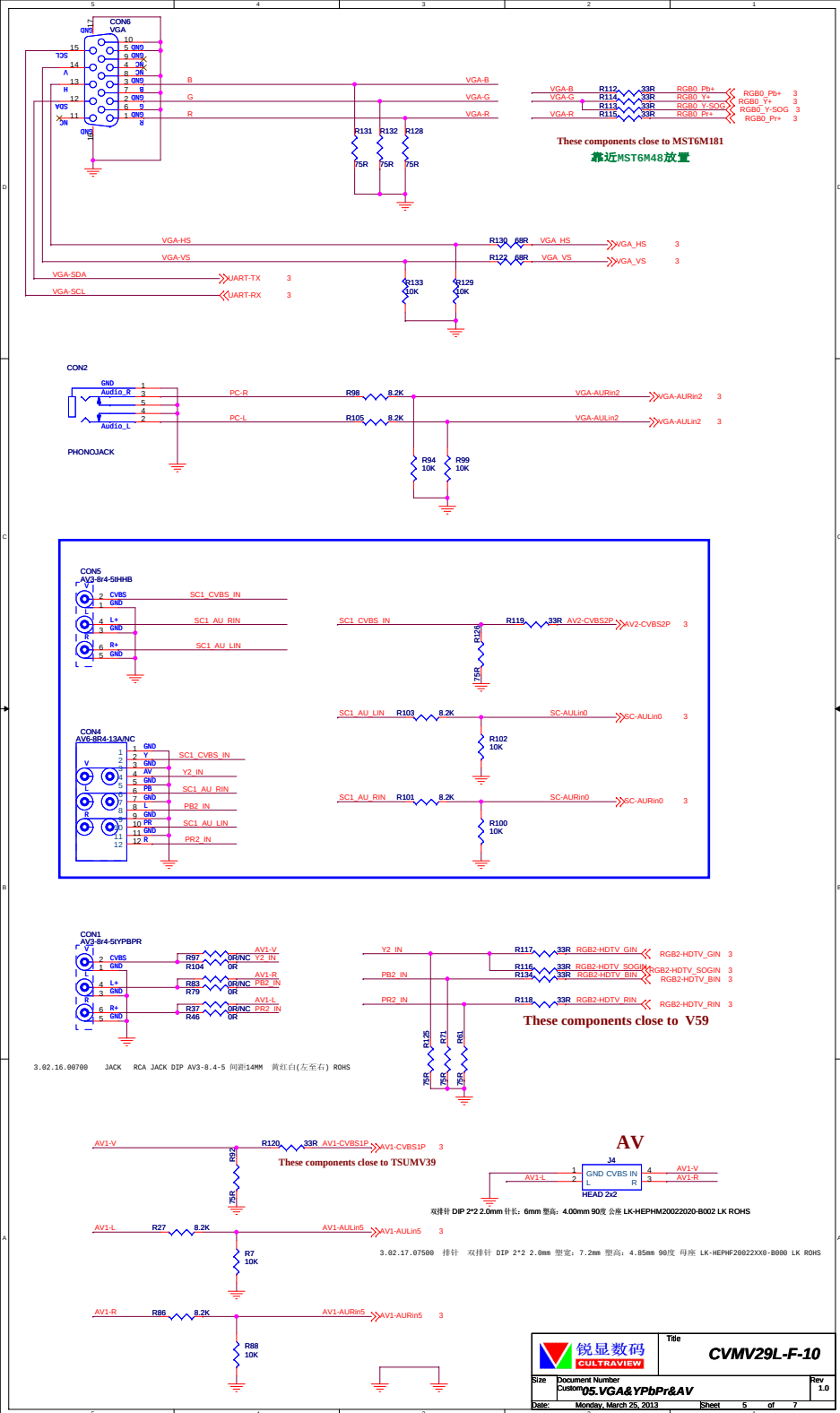
IC Power

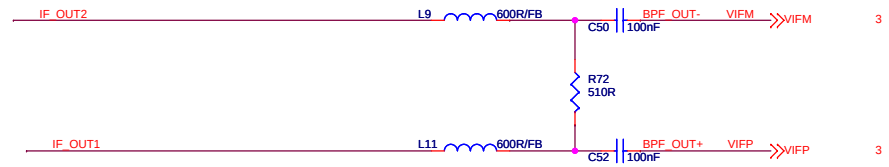
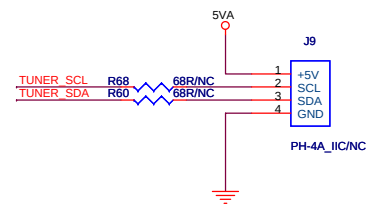
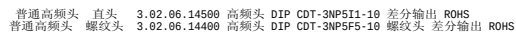
Close to IC



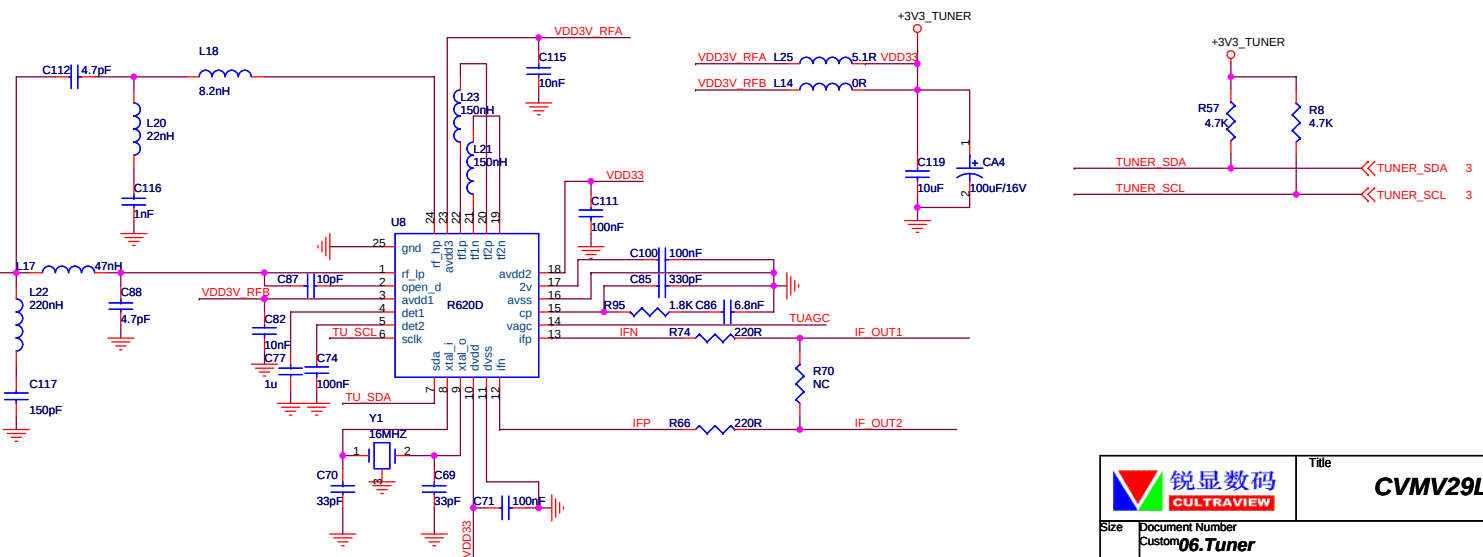
CHIP_CONFIG



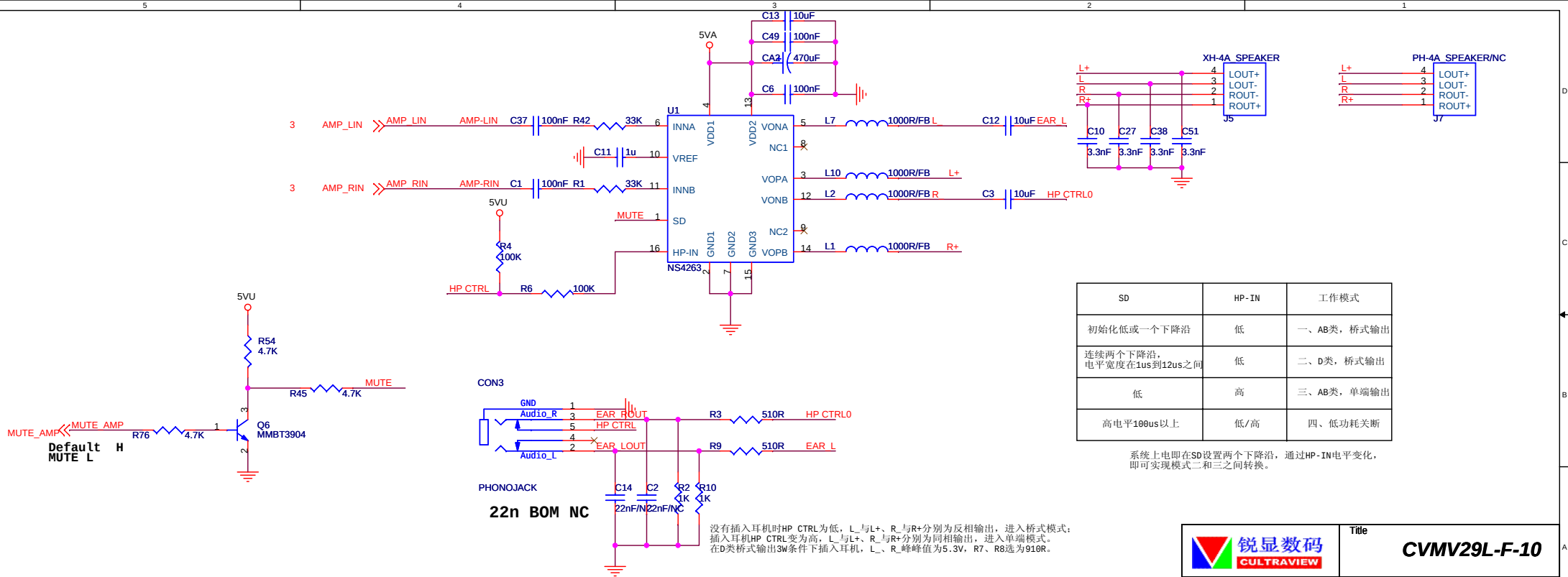




NTSC用3.02.16.20970 RF JACK DIP 卧式 母座 美规 屏蔽一体 分盖 外铁内铜 LHD ROHS



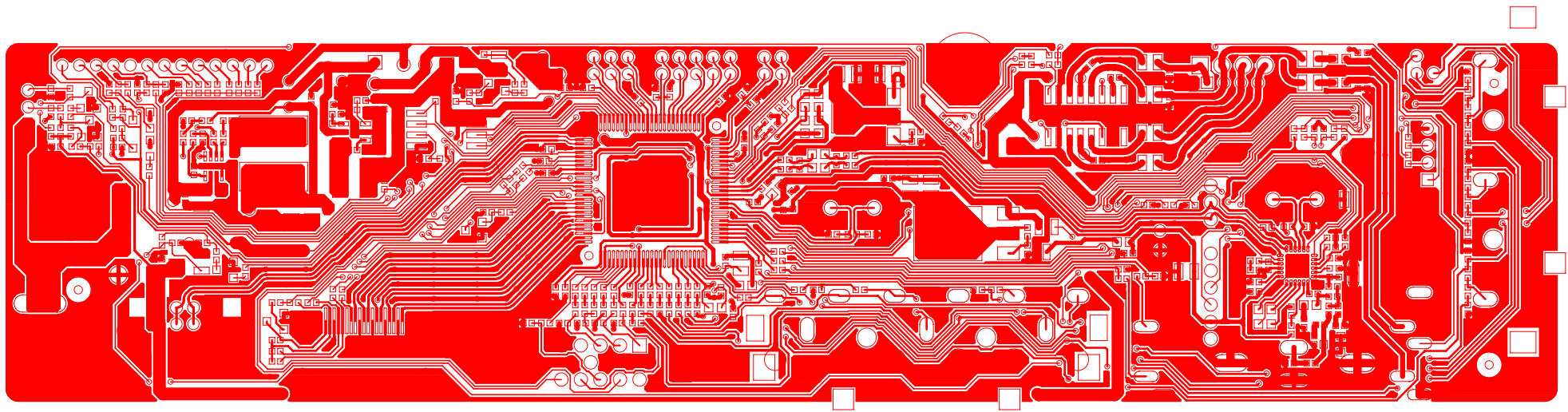
		Title CVMV29L-F-10	
Size	Document Number Custom 06.Tuner	Rev 1.0	
Date:	Thursday, March 28, 2013	Sheet	6 of 7

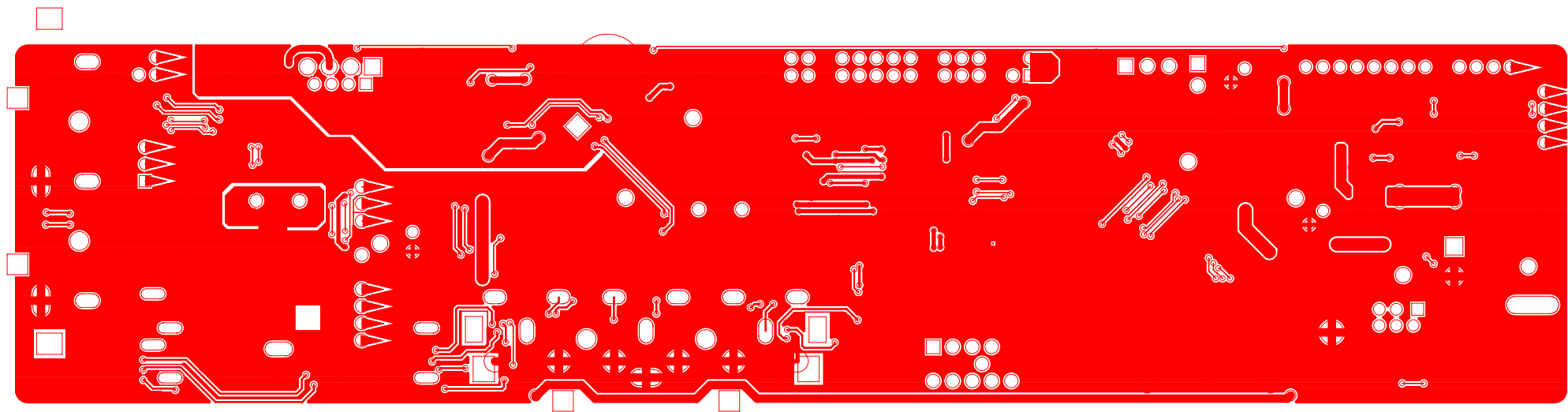


SD	HP-IN	工作模式
初始化低或一个下降沿	低	一、AB类，桥式输出
连续两个下降沿， 电平宽度在1us到12us之间	低	二、D类，桥式输出
低	高	三、AB类，单端输出
高电平100us以上	低/高	四、低功耗关断

系统上电即在SD设置两个下降沿，通过HP-IN电平变化，即可实现模式二和三之间转换。

 锐显数码 CULTRAVIEW		Title CVMV29L-F-10	
Size	Document Number Custom	07.AMP	
Date: Thursday, March 28, 2013		Sheet 7 of 7	
		Rev 1.0	





CV29L-F-10

Common problems solution

- System Chart**
- Power Units Problem Solving**
- Display Units Problem Solving**
- Audio Units Problem Solving**
- Functional Units Problem Solving**

CV29L-F-10 System Block

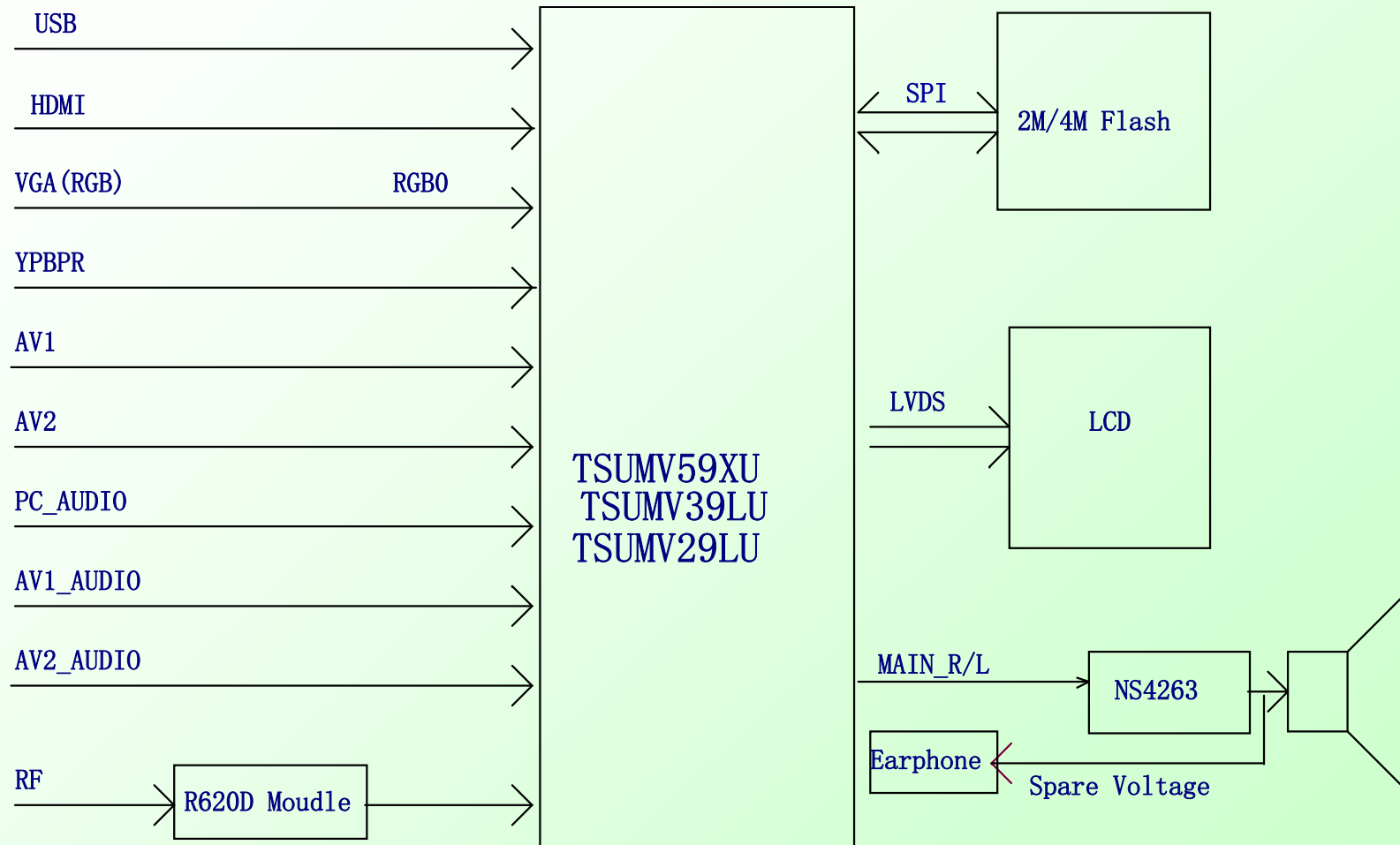
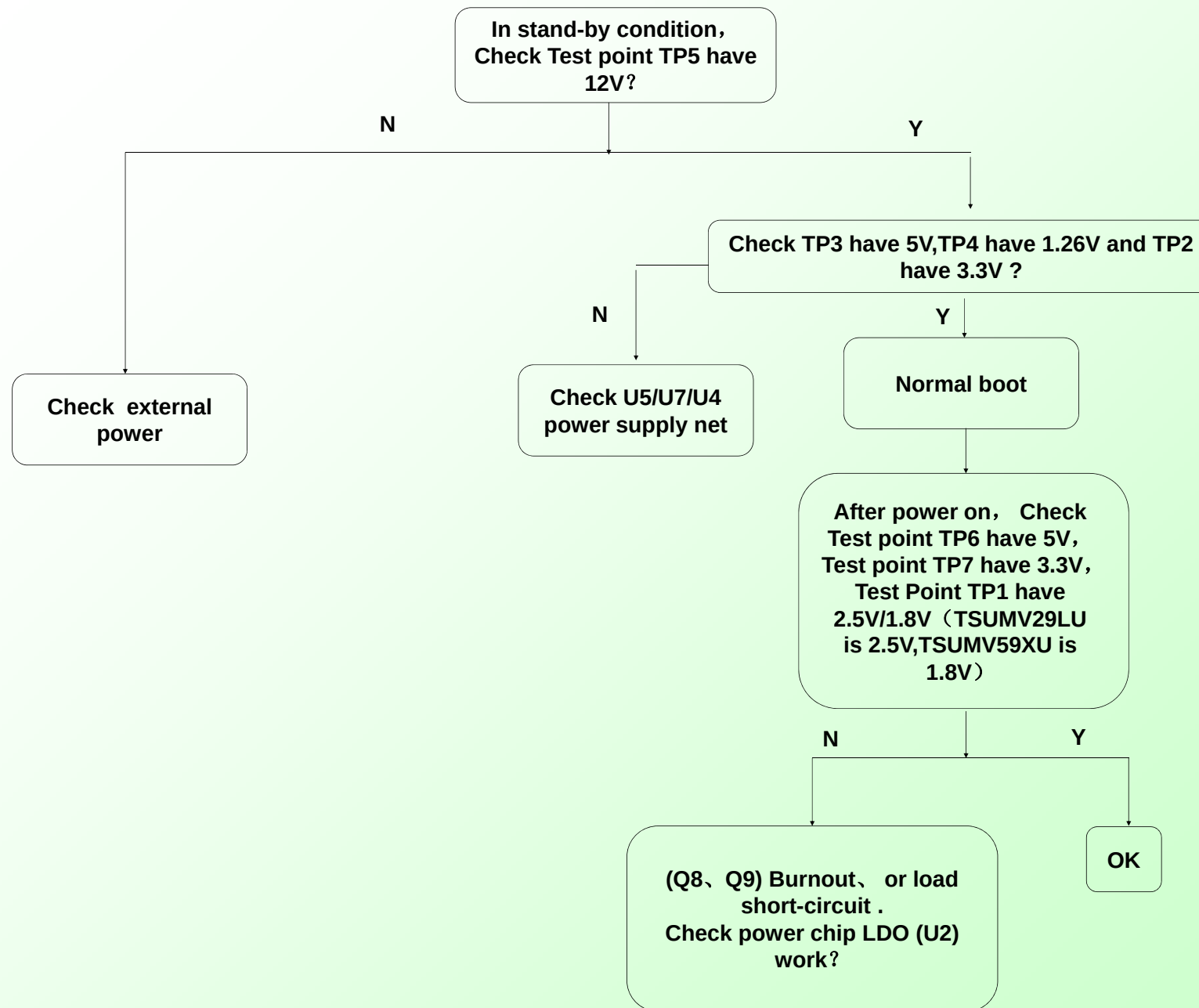
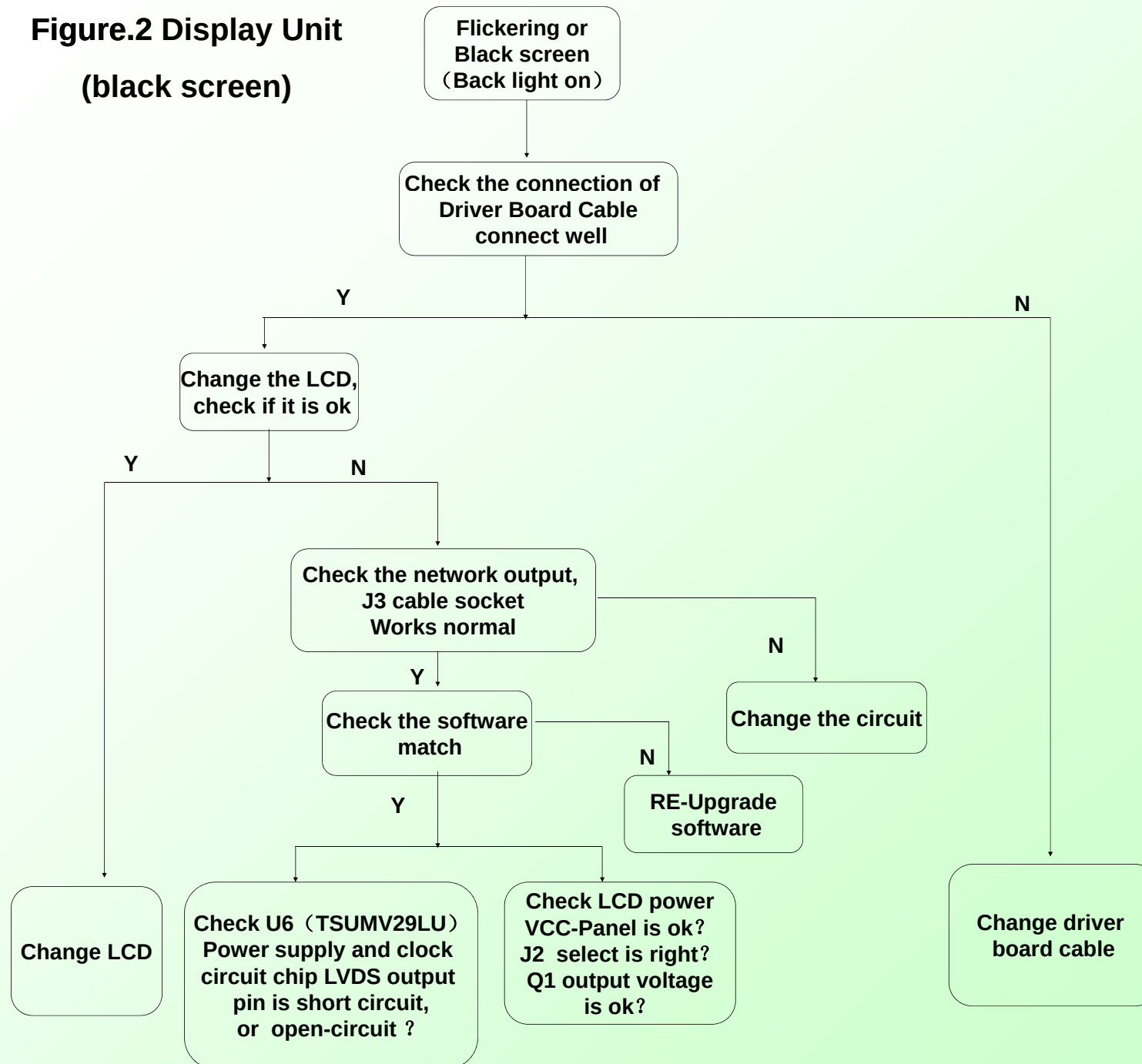


Figure.1 Power Units Problem Solving



**Figure.2 Display Unit
(black screen)**



**Figure.3 Display Unit
(black screen)**

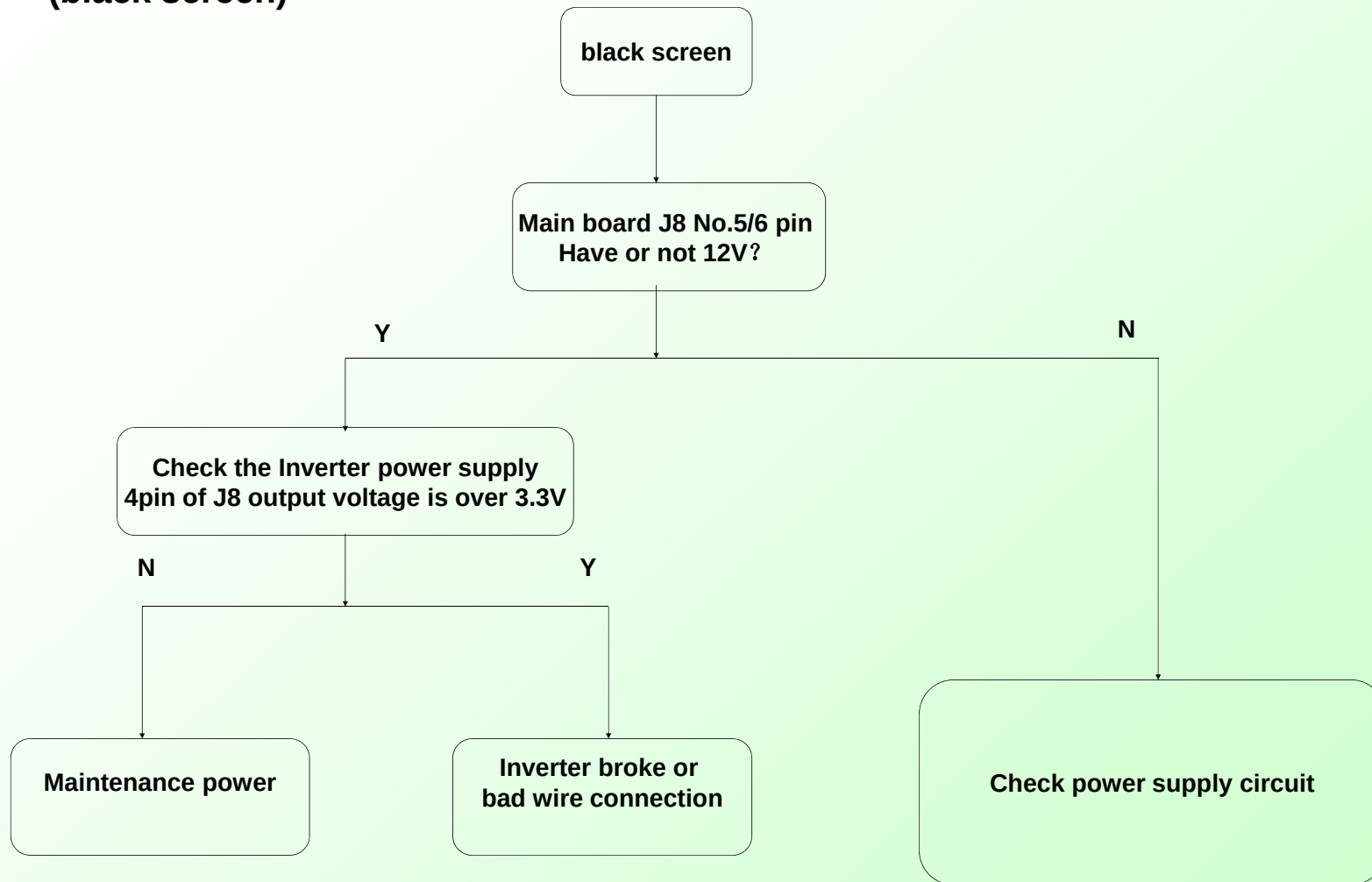
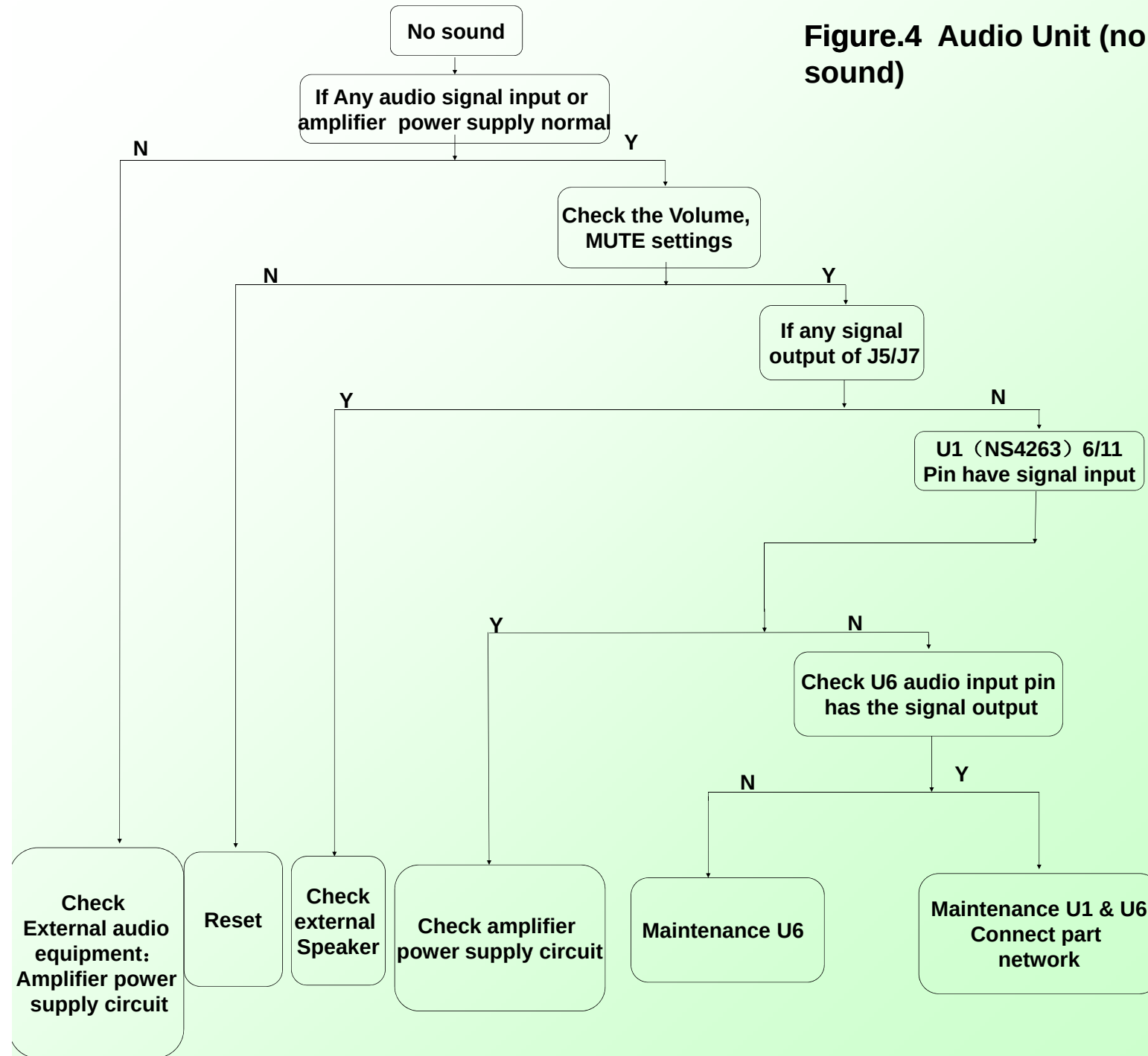
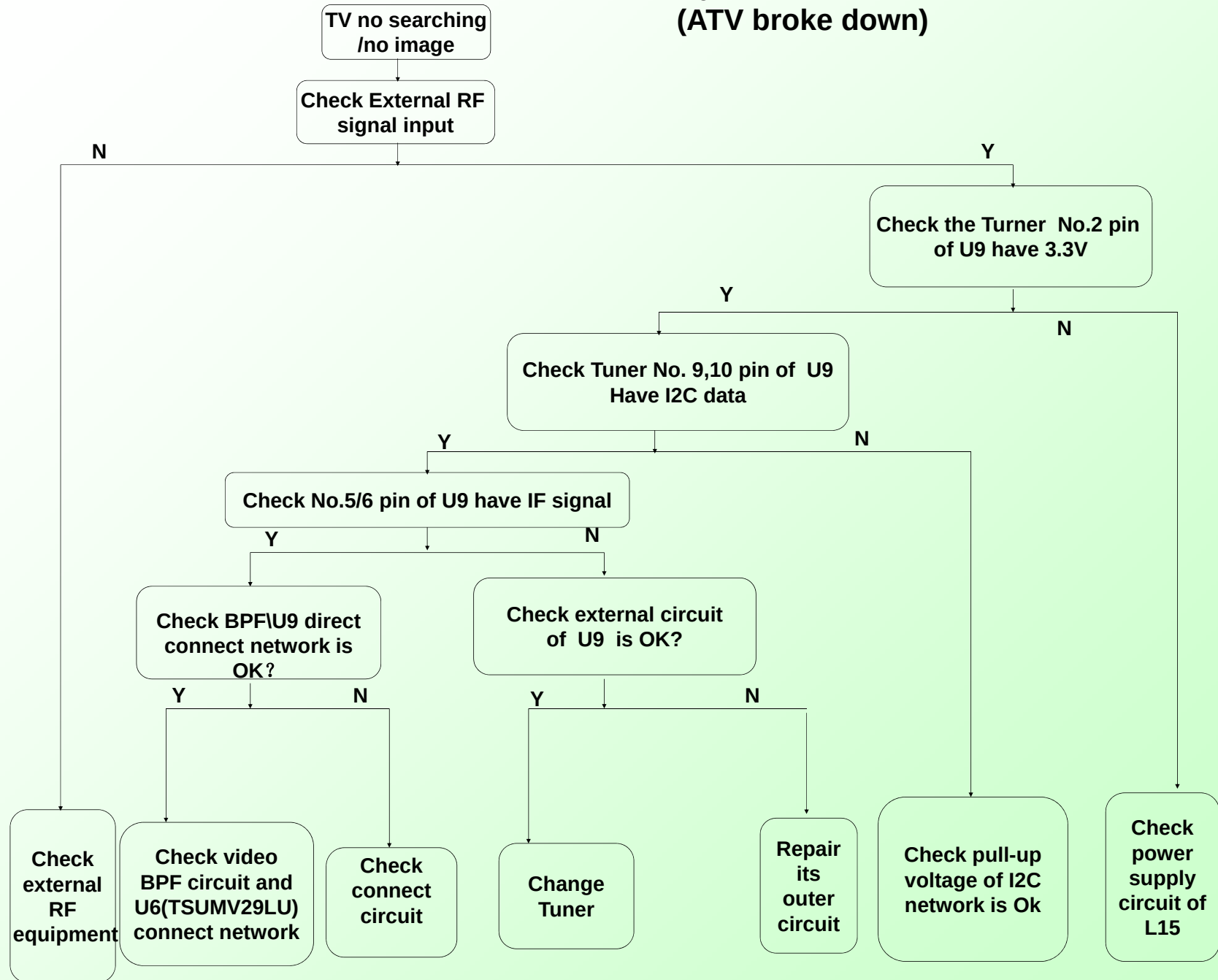


Figure.4 Audio Unit (no sound)



**Figure.5 Function Unit
(ATV broke down)**



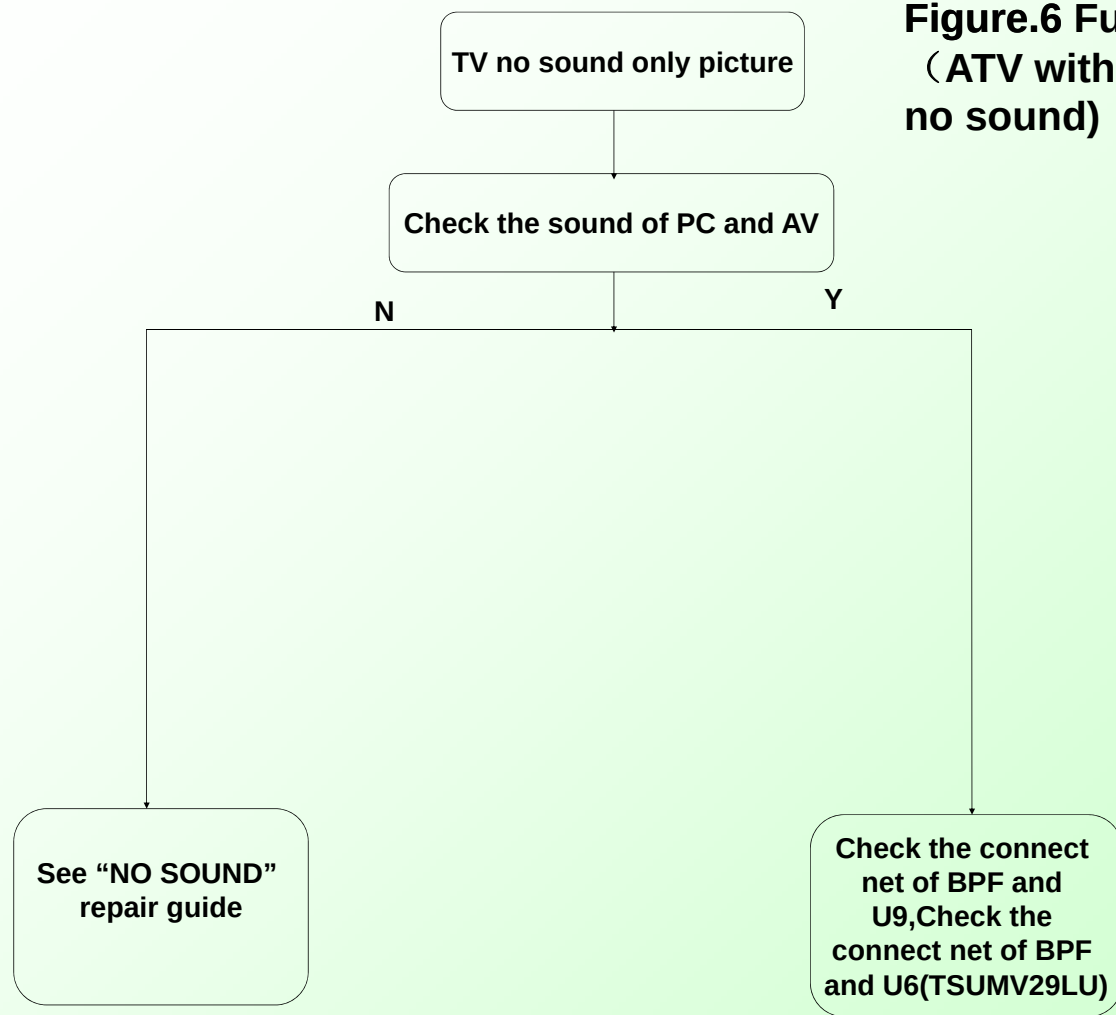


Figure.6 Function Unit
(ATV with the image but
no sound)

Figure.7 Function Unit (PC)

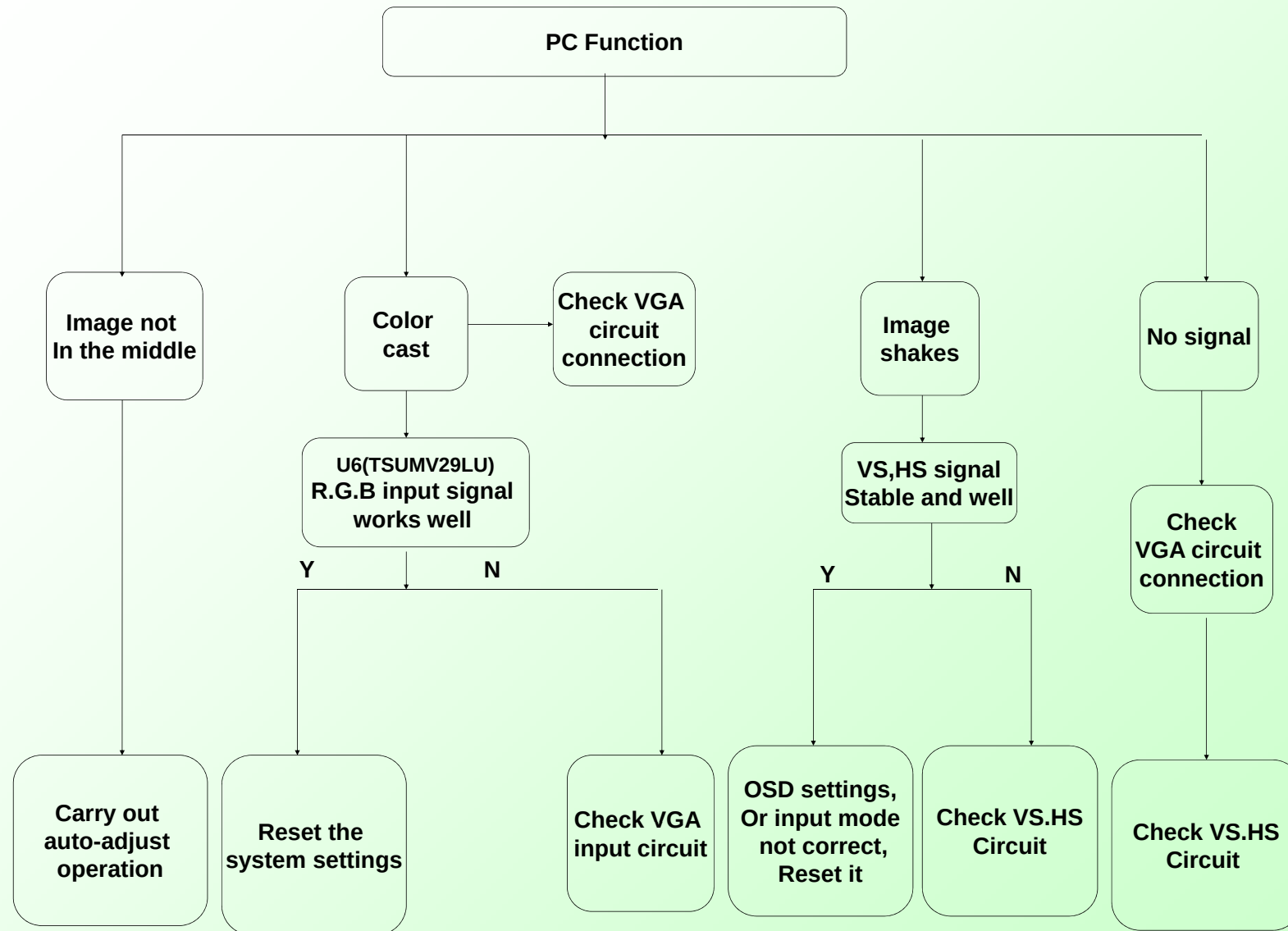
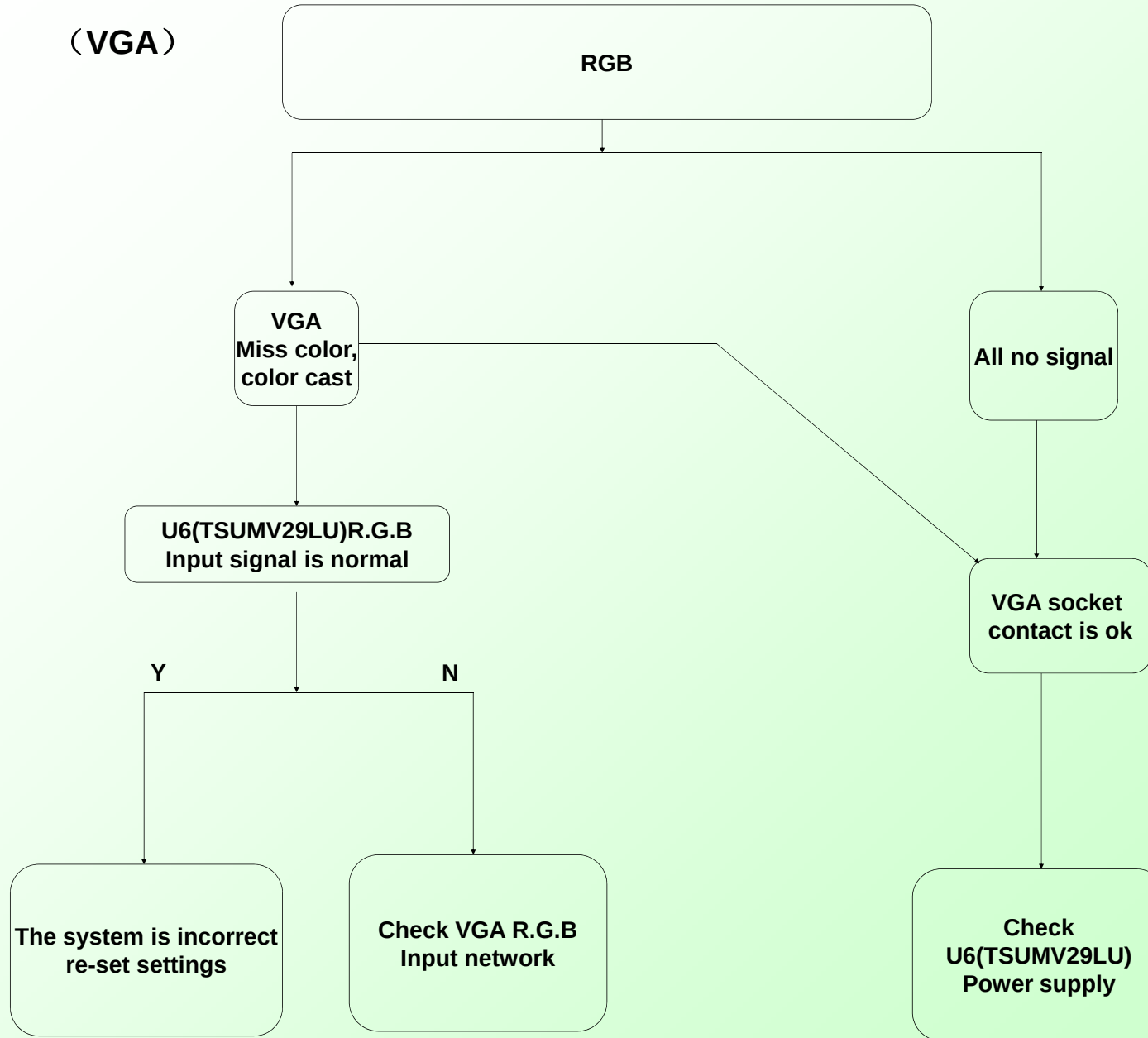
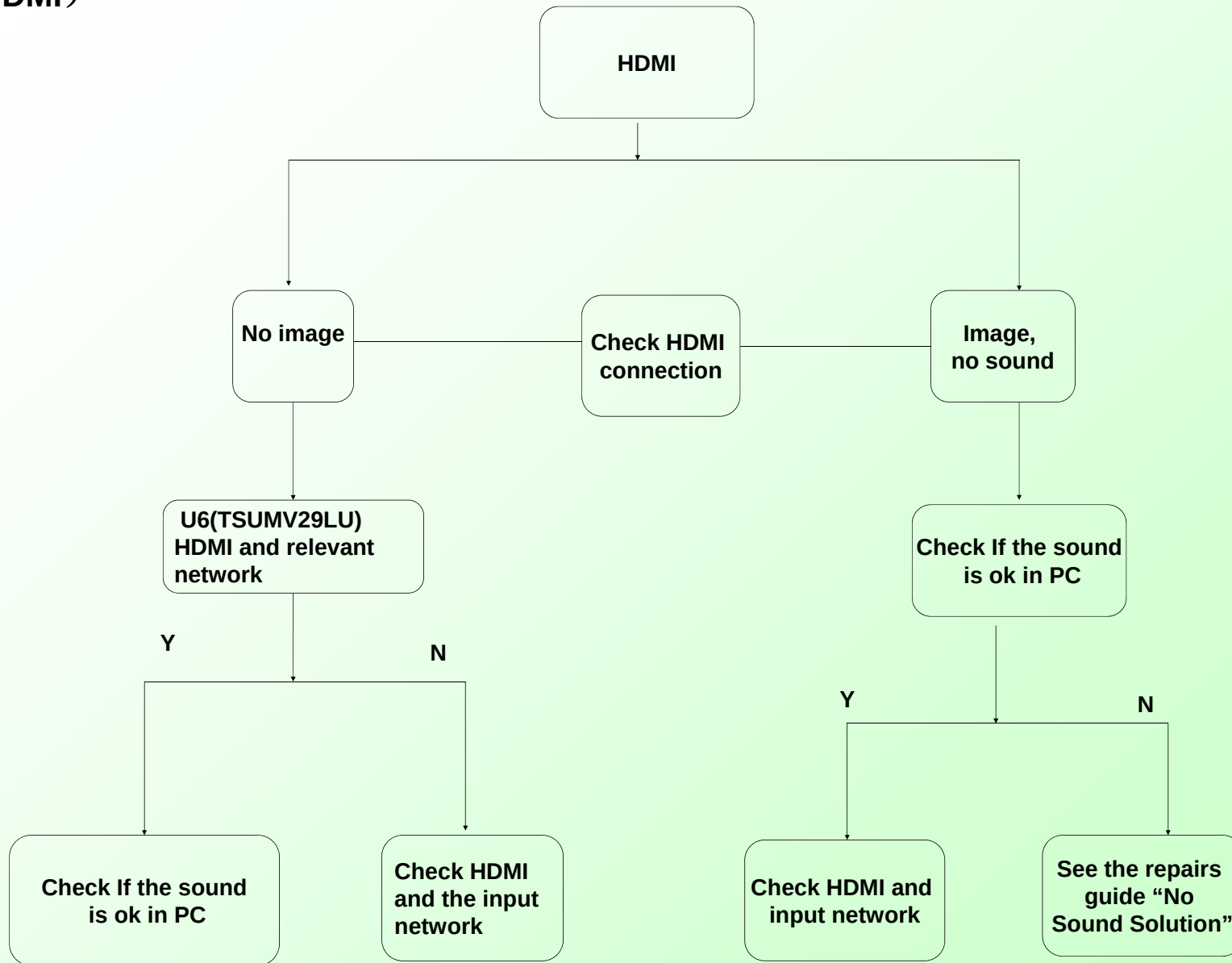


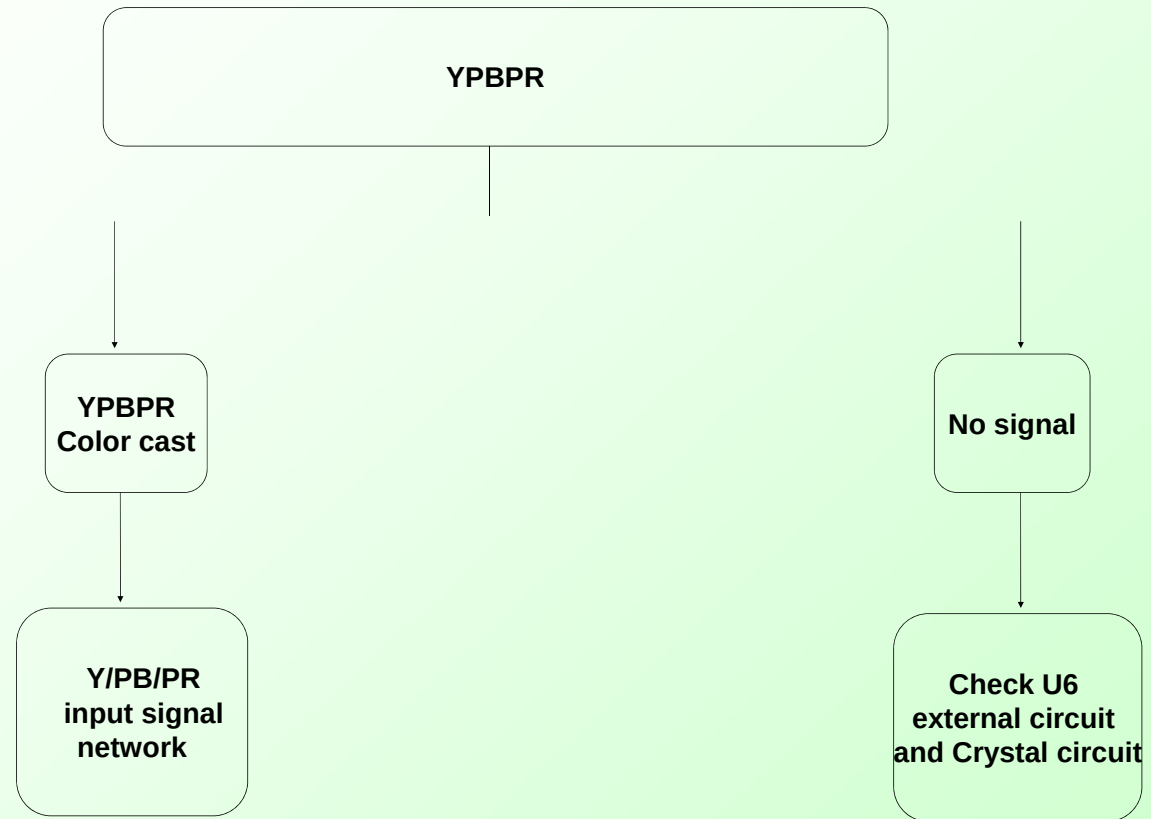
Figure.8 Function Unit
(VGA)



**Figure.9 Function Unit
(HDMI)**



**Figure.10 Function Unit
(YPBPR)**



Doc. Number:

- ☐ Tentative Specification
☒ Preliminary Specification
☐ Approval Specification

MODEL NO.: N156BGE
SUFFIX: L21

Customer:

APPROVED BY

SIGNATURE

Name / Title

Note

Please return 1 copy for your confirmation with your signature and comments.

Approved By	Checked By	Prepared By
楊竣傑	陳逸銘	王淑玲
2011-01-10 11:13:00 CST	2011-01-10 08:04:46 CST	2010-12-20 17:19:10 CST

CONTENTS

1. GENERAL DESCRIPTION	4
1.1 OVERVIEW	4
1.2 GENERAL SPECIFICATIONS	4
2. MECHANICAL SPECIFICATIONS	4
2.1 CONNECTOR TYPE	4
3. ABSOLUTE MAXIMUM RATINGS	5
3.1 ABSOLUTE RATINGS OF ENVIRONMENT	5
3.2 ELECTRICAL ABSOLUTE RATINGS.....	5
3.2.1 TFT LCD MODULE	5
4. ELECTRICAL SPECIFICATIONS.....	6
4.1 FUNCTION BLOCK DIAGRAM.....	6
4.2. INTERFACE CONNECTIONS	6
4.3 ELECTRICAL CHARACTERISTICS.....	8
4.3.1 LCD ELETRONICS SPECIFICATION.....	8
4.3.2 LED CONVERTER SPECIFICATION.....	10
4.3.3 BACKLIGHT UNIT.....	12
4.4 LVDS INPUT SIGNAL TIMING SPECIFICATIONS	13
4.4.1 LVDS DC SPECIFICATIONS	13
4.4.2 LVDS DATA FORMAT	13
4.4.3 COLOR DATA INPUT ASSIGNMENT	14
4.5 DISPLAY TIMING SPECIFICATIONS	15
4.6 POWER ON/OFF SEQUENCE	16
5. OPTICAL CHARACTERISTICS	17
5.1 TEST CONDITIONS.....	17
5.2 OPTICAL SPECIFICATIONS	17
6. RELIABILITY TEST ITEM	20
7. PACKING.....	22
7.1 MODULE LABEL	22
7.2 CARTON	23
7.3 PALLET	24
8. PRECAUTIONS	25
8.1 HANDLING PRECAUTIONS.....	25
8.2 STORAGE PRECAUTIONS	25
8.3 OPERATION PRECAUTIONS.....	25
Appendix. EDID DATA STRUCTURE.....	26
Appendix. OUTLINE DRAWING	29

REVISION HISTORY

Version	Date	Page	Description
1.0	Aug.09, 2010	All	Spec Ver.1.0 was first issued.

1. GENERAL DESCRIPTION

1.1 OVERVIEW

N156BGE-L21 is a 15.6" (15.547" diagonal) TFT Liquid Crystal Display module with LED Backlight unit and 40 pins LVDS interface. This module supports 1366 x 768 HD mode and can display 262,144 colors. The optimum viewing angle is at 6 o'clock direction.

1.2 GENERAL SPECIFICATIONS

Item	Specification	Unit	Note
Screen Size	15.547 diagonal		
Driver Element	a-si TFT active matrix	-	-
Pixel Number	1366 x R.G.B. x 768	pixel	-
Pixel Pitch	0.252 (H) x 0.252 (V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	262,144	color	-
Transmissive Mode	Normally white	-	-
Surface Treatment	Hard coating (3H), Glare	-	-
Luminance, White	220	Cd/m2	
Power Consumption	Total 5.184 W (Max.) @ cell 0.9 W (Max.), BL 4.284W (Max.)		(1)

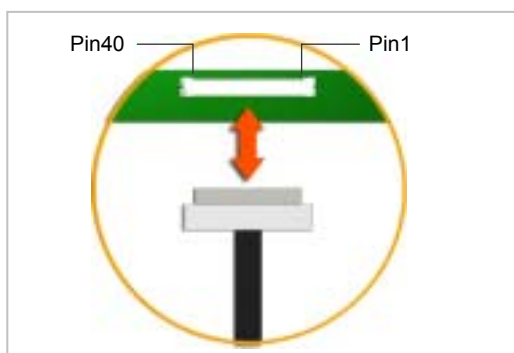
Note (1) The specified power consumption (with converter efficiency) is under the conditions at VCCS = 3.3 V, $f_v = 60$ Hz, LED_VCCS = Typ, fPWM = 200 Hz, Duty=100% and $T_a = 25 \pm 2$ °C, whereas mosaic pattern is displayed.

2. MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	358.8	359.3	359.8	mm	(1)
	Vertical (V)	209	209.5	210	mm	
	Thickness (T)	-	5.2	5.5	mm	
Bezel Area	Horizontal	349.28	349.58	349.88	mm	
	Vertical	197.99	198.29	198.59	mm	
Active Area	Horizontal	-	344.232	-	mm	
	Vertical	-	193.536	-	mm	
Weight		-	430	445	g	

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

2.1 CONNECTOR TYPE



Please refer Appendix Outline Drawing for detail design.

Connector Part No.: IPEX-20455-040E-12 or equivalent

User's connector Part No: IPEX-20453-040T-01 or equivalent

3. ABSOLUTE MAXIMUM RATINGS

3.1 ABSOLUTE RATINGS OF ENVIRONMENT

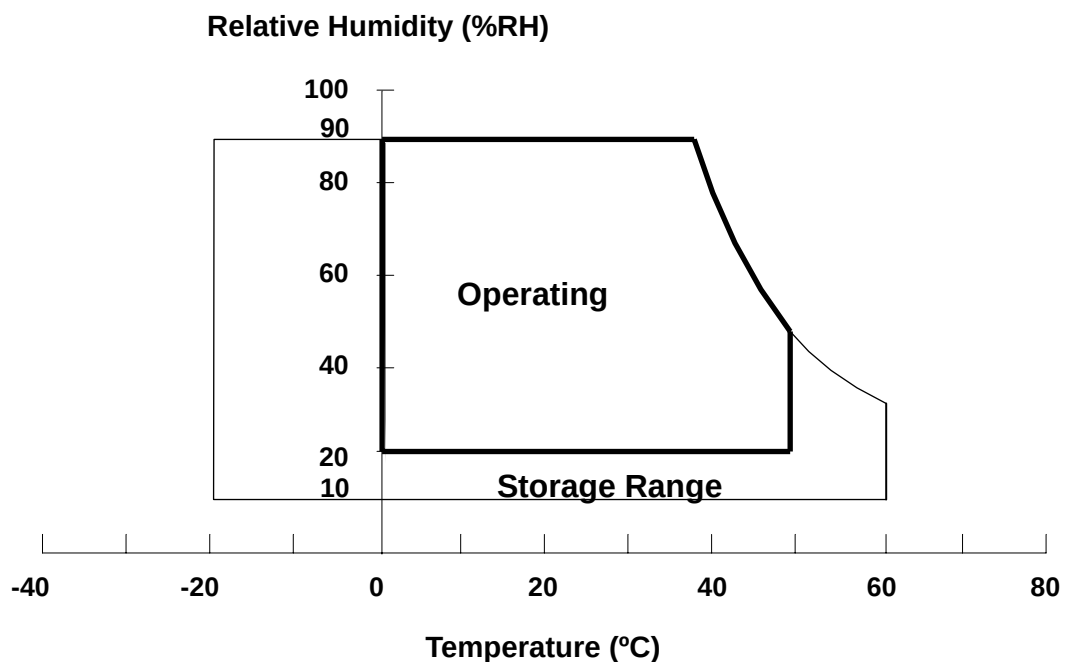
Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T _{ST}	-20	+60	°C	(1)
Operating Ambient Temperature	T _{OP}	0	+50	°C	(1), (2)

Note (1) (a) 90 %RH Max. (Ta ≤ 40 °C).

(b) Wet-bulb temperature should be 39 °C Max. (Ta > 40 °C).

(c) No condensation.

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



3.2 ELECTRICAL ABSOLUTE RATINGS

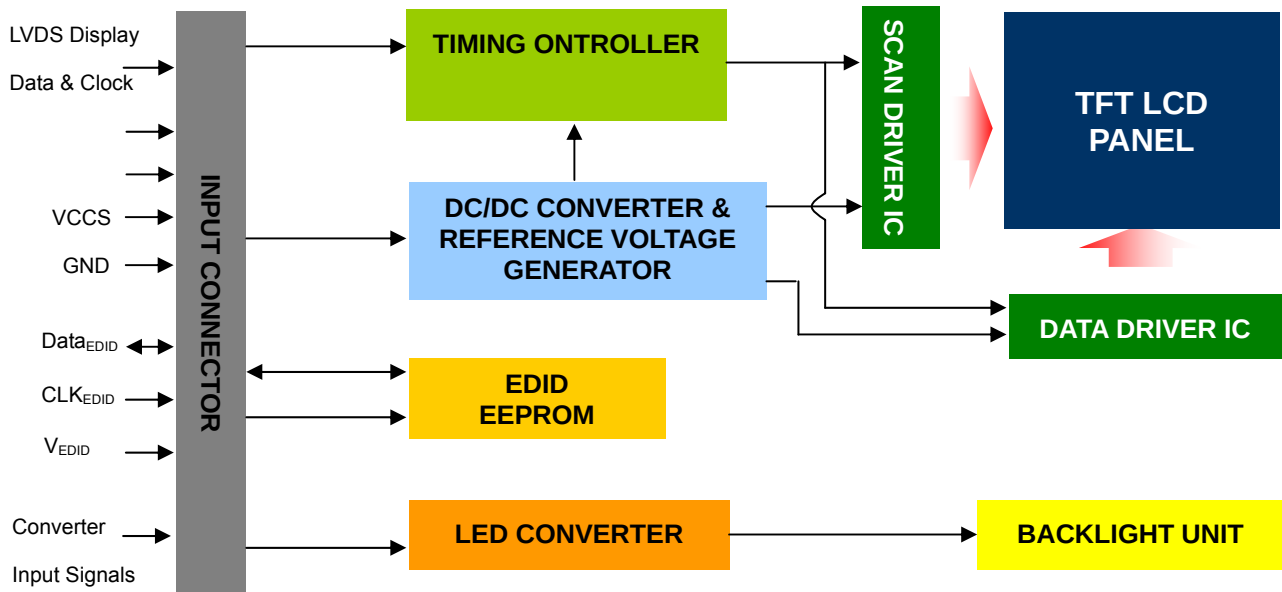
3.2.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	VCCS	-0.3	+4.0	V	(1)
Logic Input Voltage	V _{IN}	-0.3	VCCS+0.3	V	
Converter Input Voltage	LED_VCCS	-0.3	24	V	(1)
Converter Control Signal Voltage	LED_PWM,	-0.3	5	V	(1)
Converter Control Signal Voltage	LED_EN	-0.3	5	V	(1)

Note (1) Stresses beyond those listed in above “ELECTRICAL ABSOLUTE RATINGS” may cause permanent damage to the device. Normal operation should be restricted to the conditions described in “ELECTRICAL CHARACTERISTICS”.

4. ELECTRICAL SPECIFICATIONS

4.1 FUNCTION BLOCK DIAGRAM



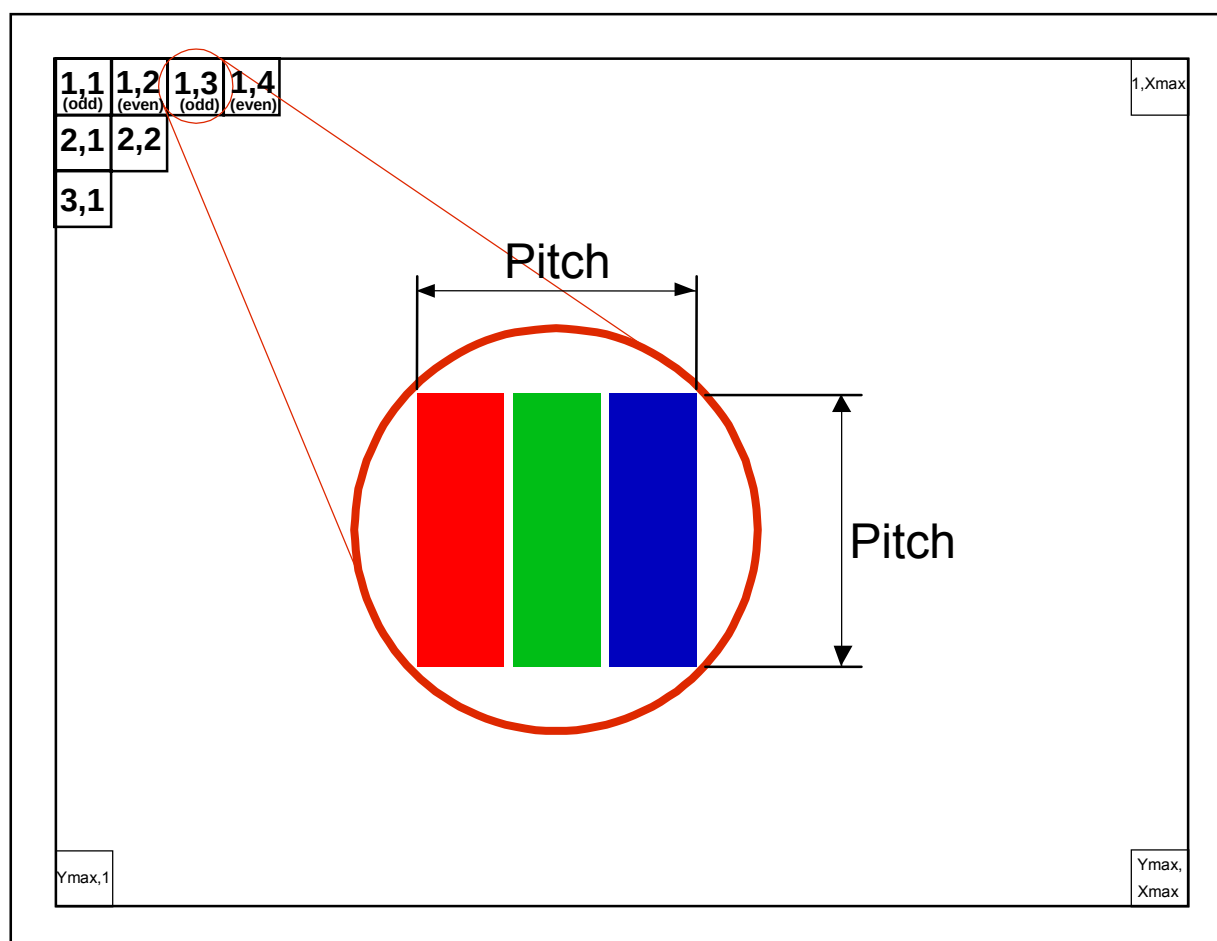
4.2. INTERFACE CONNECTIONS

PIN ASSIGNMENT

Pin	Symbol	Description	Remark
1	NC	No Connection (Reserve)	
2	VCCS	Power Supply (3.3V typ.)	
3	VCCS	Power Supply (3.3V typ.)	
4	VEDID	DDC 3.3V power	
5	NC	No Connection (Reserved for CMI test)	
6	CLKEDID	DDC clock	
7	DATAEDID	DDC data	
8	Rxin0-	LVDS differential data input	R0-R5, G0
9	Rxin0+	LVDS differential data input	
10	VSS	Ground	
11	Rxin1-	LVDS differential data input	G1~G5, B0, B1
12	Rxin1+	LVDS differential data input	
13	VSS	Ground	
14	Rxin2-	LVDS Differential Data Input	B2-B5,HS,VS, DE
15	Rxin2+	LVDS Differential Data Input	
16	VSS	Ground	
17	RxCLK-	LVDS differential clock input	LVDS CLK
18	RxCLK+	LVDS differential clock input	
19	VSS	Ground	
20	NC	No Connection (Reserve)	
21	NC	No Connection (Reserve)	
22	VSS	Ground	
23	NC	No Connection (Reserve)	

24	NC	No Connection (Reserve)	
25	VSS	Ground	
26	NC	No Connection (Reserve)	
27	NC	No Connection (Reserve)	
28	VSS	Ground	
29	NC	No Connection (Reserve)	
30	NC	No Connection (Reserve)	
31	LED_GND	LED Ground	
32	LED_GND	LED Ground	
33	LED_GND	LED Ground	
34	NC	No Connection (Reserve)	
35	LED_PWM	PWM Control Signal of LED Converter	
36	LED_EN	Enable Control Signal of LED Converter	
37	NC	No Connection (Reserve)	
38	LED_VCCS	LED Power Supply	
39	LED_VCCS	LED Power Supply	
40	LED_VCCS	LED Power Supply	

Note (1) The first pixel is odd as shown in the following figure.



4.3 ELECTRICAL CHARACTERISTICS

4.3.1 LCD ELETRONICS SPECIFICATION

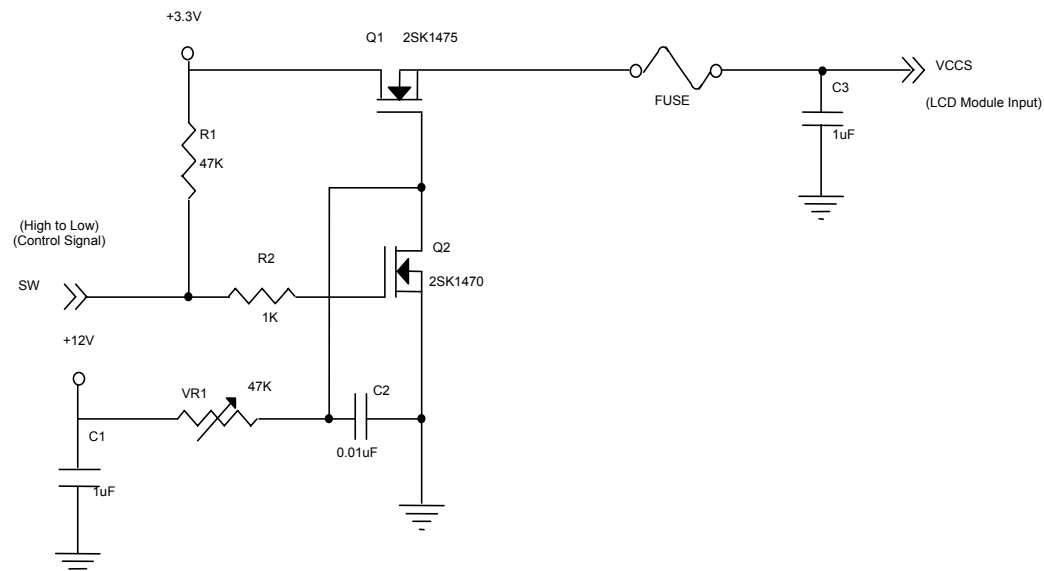
Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		VCCS	3.0	3.3	3.6	V	(1)-
Ripple Voltage		V _{RP}	-	50	-	mV	(1)-
Inrush Current		I _{RUSH}	-	-	1.5	A	(1),(2)
Power Supply Current	Mosaic	I _{CC}	253	288	323	mA	(3)a
	Black		320	360	400	mA	(3)b

Note (1) The ambient temperature is $T_a = 25 \pm 2^\circ\text{C}$.

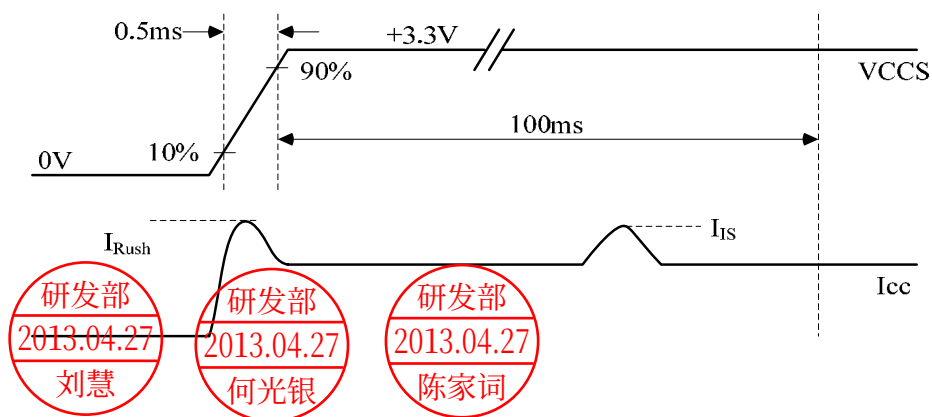
Note (2) I_{RUSH}: the maximum current when VCCS is rising

I_{IS}: the maximum current of the first 100ms after power-on

Measurement Conditions: Shown as the following figure. Test pattern: black.



VCCS rising time is 0.5ms



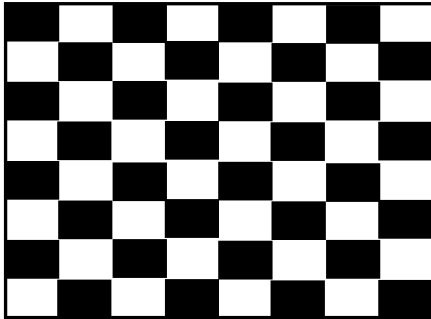
研发部
2013.04.27
刘慧

研发部
2013.04.27
何光银

研发部
2013.04.27
陈家词

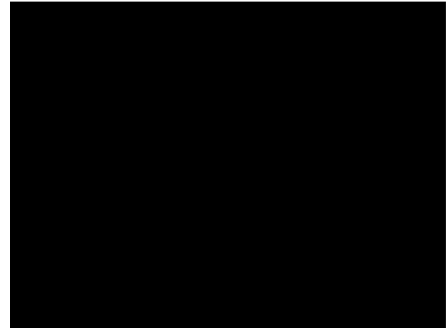
Note (3) The specified power supply current is under the conditions at $V_{CCS} = 3.3\text{ V}$, $T_a = 25 \pm 2\text{ }^{\circ}\text{C}$, DC Current and $f_v = 60\text{ Hz}$, whereas a power dissipation check pattern below is displayed.

a. Mosaic Pattern



Active Area

b. Black Pattern



Active Area

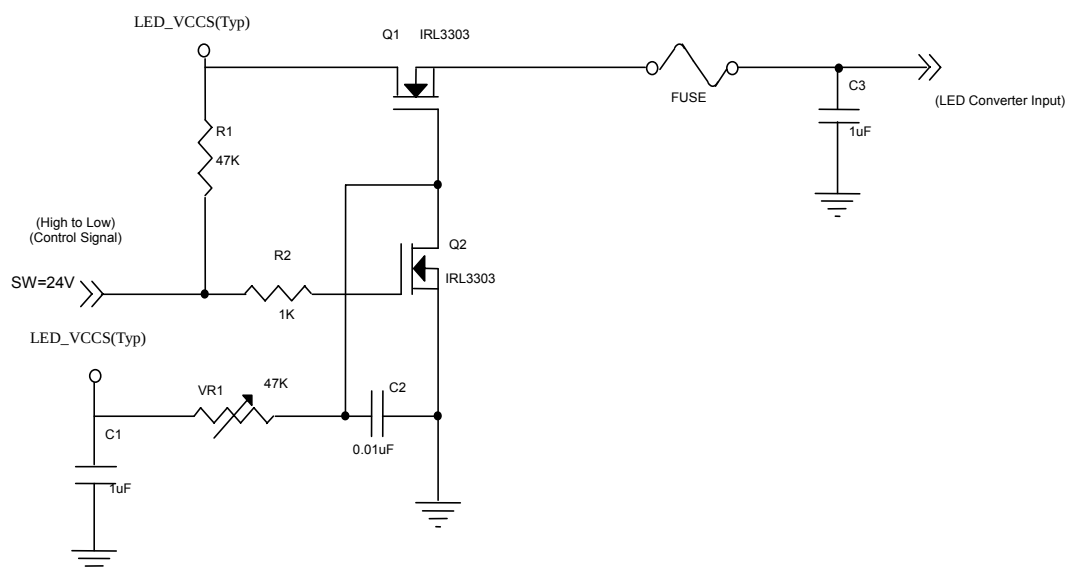
4.3.2 LED CONVERTER SPECIFICATION

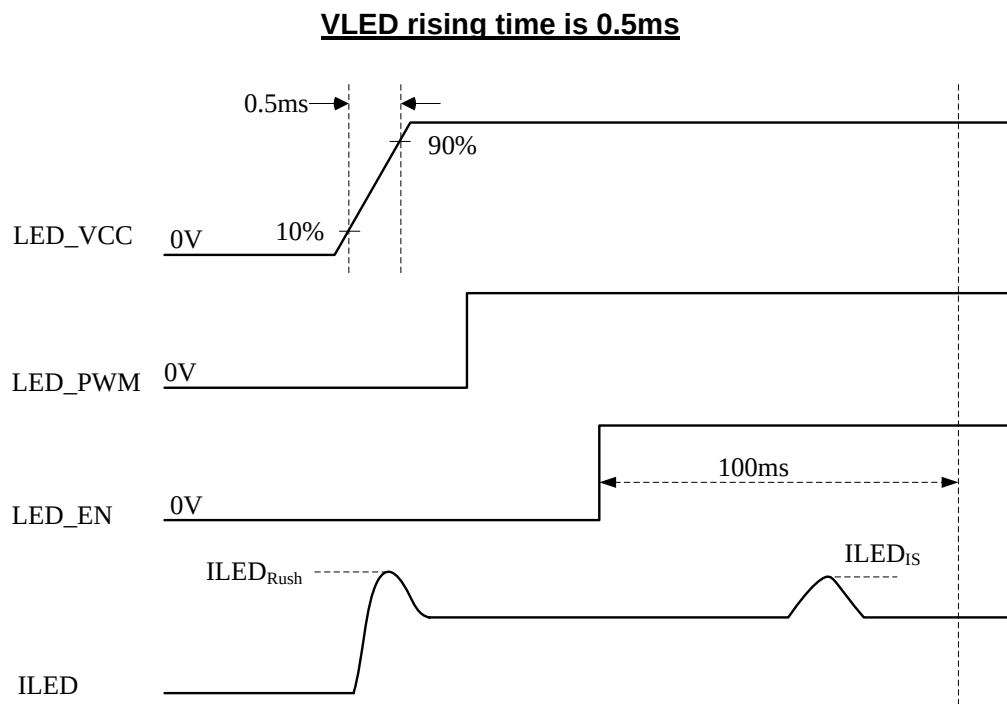
Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Converter Input power supply voltage		LED_Vccs	6.0	12.0	21.0	V	
Converter Inrush Current		I _{LED_RUSH}	-	-	1.5	A	(1)
EN Control Level	Backlight On		2.3	-	5	V	
	Backlight Off		0	-	0.5	V	
PWM Control Level	PWM High Level		2.3	-	5	V	
	PWM Low Level		0	-	0.5	V	
PWM Control Duty Ratio			10	-	100	%	
			5	-	100	%	(2)
PWM Control Permissive Ripple Voltage		V _{PWM_pp}	-	-	100	mV	
PWM Control Frequency		f _{PWM}	190	-	2K	Hz	(3)
LED Power Current	LED_VCCS =Typ.	I _{LED}	253	301	357	mA	(4)

Note (1) I_{LED_RUSH}: the maximum current when LED_VCCS is rising,

I_{LED_IS}: the maximum current of the first 100ms after power-on,

Measurement Conditions: Shown as the following figure. LED_VCCS = Typ, Ta = 25 ± 2 °C, f_{PWM} = 200 Hz, Duty=100%.





Note (2) If the PWM control duty ratio is less than 10%, there is some possibility that acoustic noise or backlight flash can be found. And it is also difficult to control the brightness linearity.

Note (3) If PWM control frequency is applied in the range less than 1KHz, the “waterfall” phenomenon on the screen may be found. To avoid the issue, it’s a suggestion that PWM control frequency should follow the criterion as below.

PWM control frequency f_{PWM} should be in the range

$$(N + 0.33) * f \leq f_{PWM} \leq (N + 0.66) * f$$

N : Integer ($N \geq 3$)

f : Frame rate

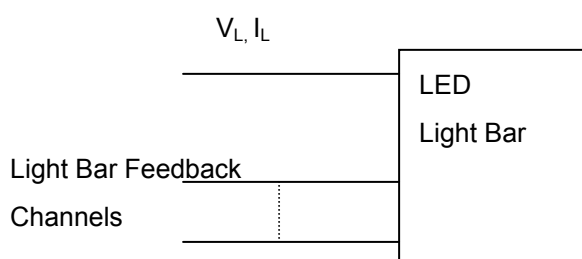
Note (4) The specified LED power supply current is under the conditions at “LED_VCCS = Typ.”, $T_a = 25 \pm 2 \text{ }^\circ\text{C}$, $f_{PWM} = 200 \text{ Hz}$, Duty=100%.

4.3.3 BACKLIGHT UNIT

Ta = 25 ± 2 °C

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
LED Light Bar Power Supply Voltage	V _L	22.4	25.6	27.2	V	(1)(2)(Duty100%)
LED Light Bar Power Supply Current	I _L	114	120	126	mA	
Power Consumption	P _L	2.55	3.07	3.43	W	(3)
LED Life Time	L _{BL}	15000	-	-	Hrs	(4)

Note (1) LED current is measured by utilizing a high frequency current meter as shown below :



Note (2) For better LED light bar driving quality, it is recommended to utilize the adaptive boost converter with current balancing function to drive LED light-bar.

Note (3) $P_L = I_L \times V_L$ (Without LED converter transfer efficiency)

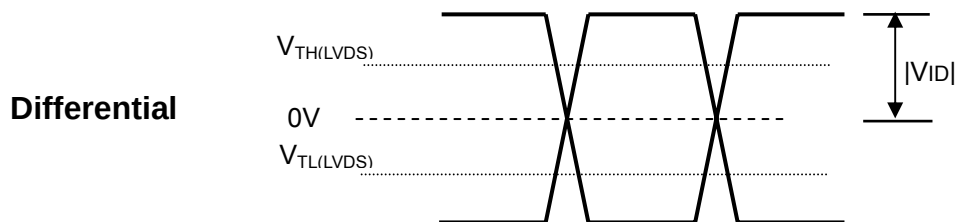
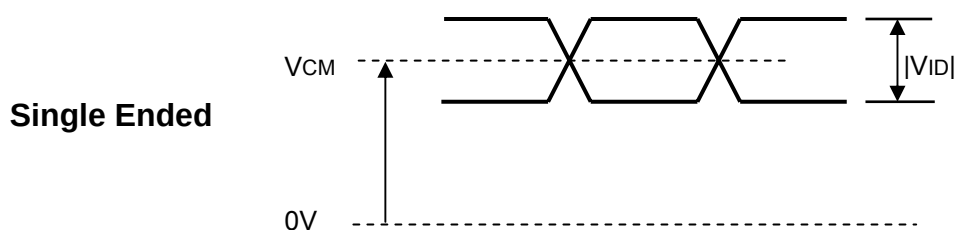
Note (4) The lifetime of LED is defined as the time when it continues to operate under the conditions at Ta = 25 ± 2 °C and I_L = 24 mA(Per EA) until the brightness becomes ≤ 50% of its original value.

4.4 LVDS INPUT SIGNAL TIMING SPECIFICATIONS

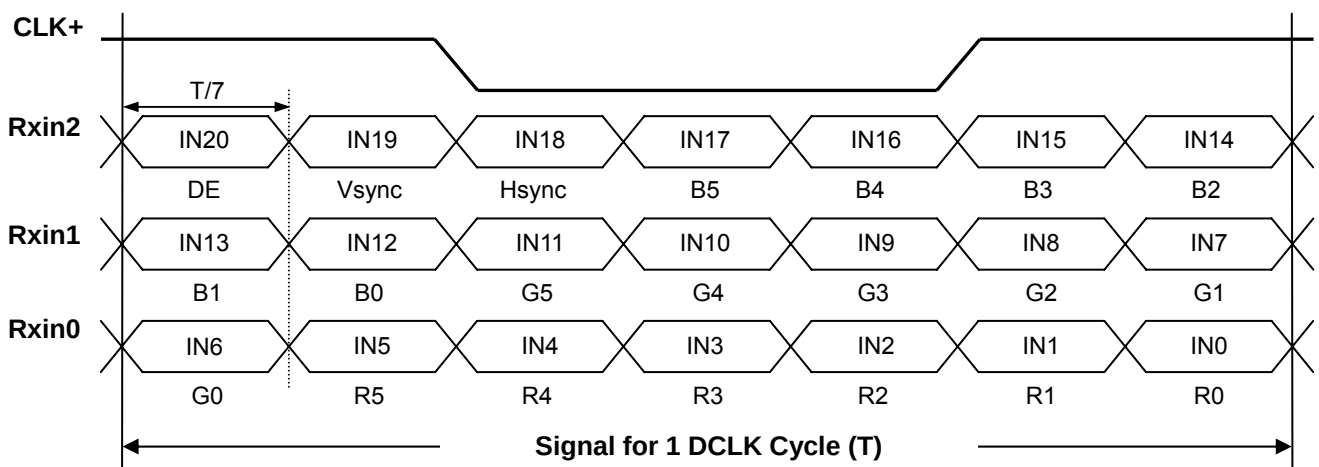
4.4.1 LVDS DC SPECIFICATIONS

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
LVDS Differential Input High Threshold	$V_{TH(LVDS)}$	-	-	+100	mV	(1), $V_{CM}=1.2V$
LVDS Differential Input Low Threshold	$V_{TL(LVDS)}$	-100	-	-	mV	(1), $V_{CM}=1.2V$
LVDS Common Mode Voltage	V_{CM}	1.125	-	1.375	V	(1)
LVDS Differential Input Voltage	$ V_{ID} $	100	-	600	mV	(1)
LVDS Terminating Resistor	R_T	-	100	-	Ohm	-

Note (1) The parameters of LVDS signals are defined as the following figures.



4.4.2 LVDS DATA FORMAT



4.4.3 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 6-bit gray scale data input for the color. The higher the binary input the brighter the color. The table below provides the assignment of color versus data input.

Color		Data Signal																	
		Red						Green						Blue					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale Of Red	Red(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(61)	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Red(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	
Gray Scale Of Green	Green(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(61)	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
	Green(62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
Green(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	
Gray Scale Of Blue	Blue(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(61)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
	Blue(62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
Blue(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	

Note (1) 0: Low Level Voltage, 1: High Level Voltage

4.5 DISPLAY TIMING SPECIFICATIONS

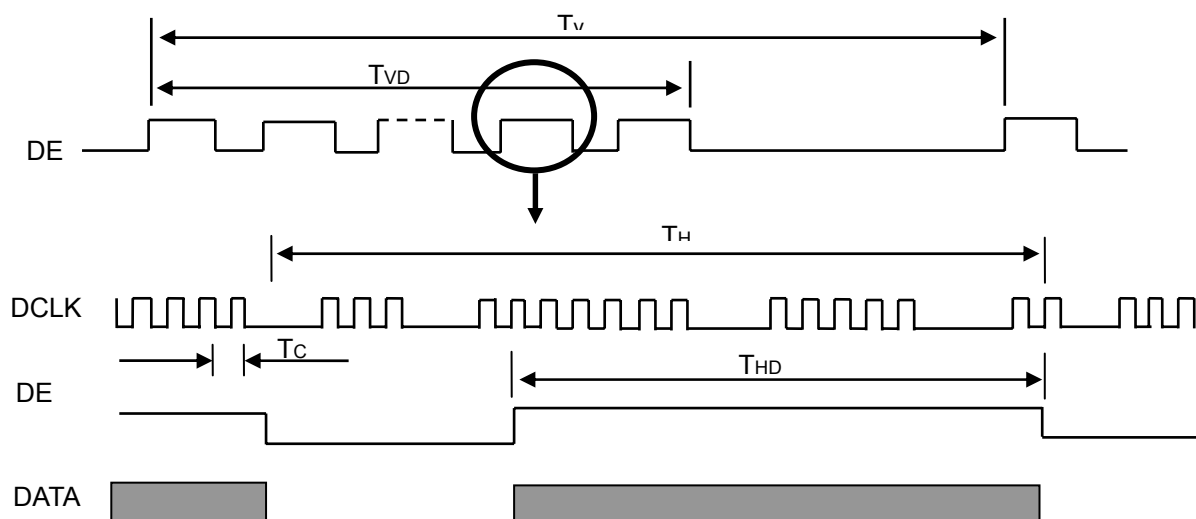
The input signal timing specifications are shown as the following table and timing diagram.

Refresh rate 60Hz

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Frequency	1/Tc	62.4	69.3	72.8	MHz	-
DE	Vertical Total Time	TV	772	788	793	TH	-
	Vertical Active Display Period	TVD	768	768	768	TH	-
	Vertical Active Blanking Period	TVB	TV-TVD	20	TV-TVD	TH	-
	Horizontal Total Time	TH	1456	1466	1492	Tc	-
	Horizontal Active Display Period	THD	1366	1366	1366	Tc	-
	Horizontal Active Blanking Period	THB	TH-THD	100	TH-THD	Tc	-

Note (1) Because this module is operated by DE only mode, Hsync and Vsync are ignored.

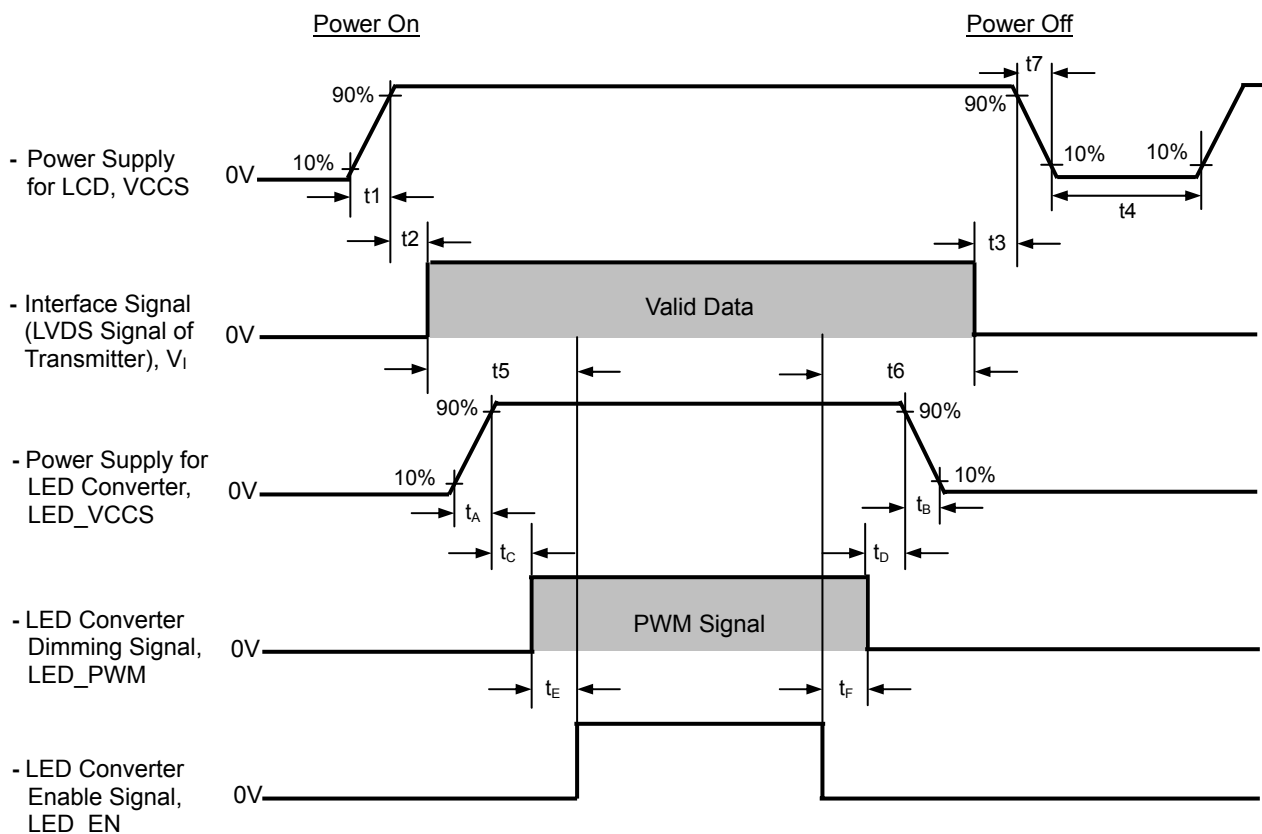
INPUT SIGNAL TIMING DIAGRAM



4.6 POWER ON/OFF SEQUENCE

The power sequence specifications are shown as the following table and diagram.

Symbol	Value			Unit	Note
	Min.	Typ.	Max.		
t1	0.5	-	10	ms	
t2	0	-	50	ms	
t3	0	-	50	ms	
t4	500	-	-	ms	
t5	200	-	-	ms	
t6	200	-	-	ms	
t7	0.5	-	10	ms	
t _A	0.5	-	10	ms	
t _B	0	-	10	ms	
t _C	10	-	-	ms	
t _D	10	-	-	ms	
t _E	10	-	-	ms	
t _F	10	-	-	ms	



Note (1) Please don't plug or unplug the interface cable when system is turned on.

Note (2) Please avoid floating state of the interface signal during signal invalid period.

Note (3) It is recommended that the backlight power must be turned on after the power supply for LCD and the interface signal is valid.

5. OPTICAL CHARACTERISTICS

5.1 TEST CONDITIONS

Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	°C
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	V _{CC}	3.3	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
LED Light Bar Input Current	I _L	120	mA

The measurement methods of optical characteristics are shown in Section 5.2. The following items should be measured under the test conditions described in Section 5.1 and stable environment shown in Note (5).

5.2 OPTICAL SPECIFICATIONS

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	$\theta_x=0^\circ, \theta_Y=0^\circ$ Viewing Normal Angle	500	650	-	-	(2),(5),(8)
Response Time		T _R		-	3	8	ms	(3),(8)
		T _F		-	8	13	ms	
Luminance of White (5P)		L _{AVE}		185	220	-	cd/m ²	(4),(5),(8)
White Variation (5P)		δW		80	--		%	(5),(6),(8)
White Variation (13P)		δW		65	--		%	(5),(6),(8)
Color gamut		C.G		55	60		%	(5),(7),(8)
Color Chromaticity	Red	R _x		Typ.- 0.03	0.617	Typ.+ 0.03	-	(1), (5) (8)
		R _y			0.340		-	
	Green	G _x			0.320		-	
		G _y			0.598		-	
	Blue	B _x			0.160		-	
		B _y			0.084		-	
	White	W _x			0.313		-	
		W _y			0.329		-	
Viewing Angle	Horizontal	θ _x +	CR≥10	40	45	-	Deg.	(1),(5),(8)
		θ _x -		40	45	-		
	Vertical	θ _Y +		15	20	-		
		θ _Y -		40	45	-		