

AKAI



SERVICE MANUAL

Model: LCT42Z6TM

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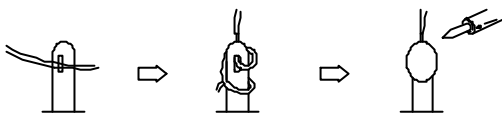
This manual is the latest at the time of printing, and does not include the modification which may be made after the printing, by the constant improvement of product.

I. Safety Instructions

 <div style="border: 1px solid black; padding: 5px; text-align: center;">CAUTION RISK OF ELECTRIC SHOCK DO NOT OPEN</div> 	<p>The lightning flash with arrowhead symbol, within an equilateral triangle, is intended to alert the user to the presence of uninsulated "dangerous voltage" within the product's enclosure that may be of sufficient magnitude to constitute a risk of electric shock to persons.</p> <p>The exclamation point within an equilateral triangle is intended to alert the user to the presence of important operating and maintenance (servicing) instructions in the literature accompanying the appliance.</p>
<p>CAUTION: TO REDUCE THE RISK OF ELECTRIC SHOCK, DO NOT REMOVE COVER (OR BACK). NO USER-SERVICEABLE PARTS INSIDE. REFER SERVICING TO QUALIFIED SERVICE PERSONNEL ONLY.</p>	

PRECAUTIONS DURING SERVICING

- In addition to safety, other parts and assemblies are specified for conformance with such regulations as those applying to spurious radiation. These must also be replaced only with specified replacements. Examples: RF converters, tuner units, antenna selection switches, RF cables, noise-blocking capacitors, noise-blocking filters, etc.
- Use specified internal Wiring. Note especially:
 - Wires covered with PVC tubing
 - Double insulated wires
 - High voltage leads
- Use specified insulating materials for hazardous live parts. Note especially:
 - Insulating Tape
 - PVC tubing
 - Spacers (insulating barriers)
 - Insulating sheets for transistors
 - Plastic screws for fixing micro switches
- When replacing AC primary side components (transformers, power cords, noise blocking capacitors, etc.), wrap ends of wires securely about the terminals before soldering.



- Make sure that wires do not contact heat generating parts (heat sinks, oxide metal film resistors, fusible resistors, etc.)
- Check if replaced wires do not contact sharply edged or pointed parts.
- Make sure that foreign objects (screws, solder droplets, etc.) do not remain inside the set.

MAKE YOUR CONTRIBUTION TO PROTECT THE ENVIRONMENT

Used batteries with the ISO symbol for recycling as well as small accumulators (rechargeable batteries), mini-batteries (cells) and starter batteries should not be thrown into the garbage can. Please leave them at an appropriate depot.



SAFETY INSTRUCTION

The service should not be attempted by anyone unfamiliar with the necessary instructions on this monitor. The following are the necessary instructions to be observed before servicing.

- An isolation transformer should be connected in the power line between the receiver and the AC line when a service is performed on the primary of the converter transformer of the set.
- Comply with all caution and safety related provided on the back of the cabinet, inside the cabinet, on the chassis or picture tube.
- To avoid a shock hazard, always discharge the picture tube's anode to the chassis ground before removing the anode cap.

4. Completely discharge the high potential voltage of the picture tube before handling. The picture tube is a vacuum and if broken, the glass will explode.
5. When replacing a MAIN PCB in the cabinet, always be certain that all protective are installed properly such as control knobs, adjustment covers or shields, barriers, isolation resistor networks etc.
6. When servicing is required, observe the original lead dressing. Extra precaution should be given to assure correct lead dressing in the high voltage area.
7. Keep wires away from high voltage or high temperature components.
8. Before returning the set to the customer, always perform an AC leakage current check on the exposed metallic parts of the cabinet, such as antennas, terminals, screwheads, metal overlay, control shafts, etc., to be sure the set is safe to operate without danger of electrical shock. Plug the AC line cord directly to the AC outlet (do not use a line isolation transformer during this check). Use an AC voltmeter having 5K ohms volt sensitivity or more in the following manner.

Connect a 1.5K ohm 10 watt resistor paralleled by a 0.15 μ F AC type capacitor, between a good earth ground (water pipe, conductor etc..) and the exposed metallic parts, one at a time.

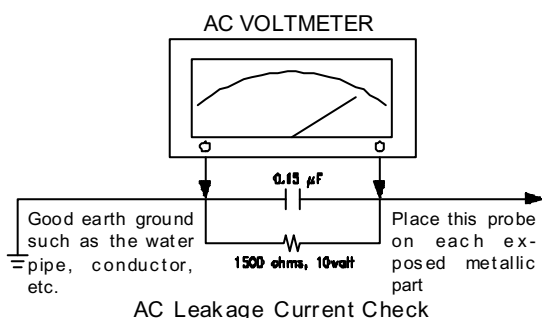
Measure the AC voltage across the combination of the 1.5K ohm resistor and 0.15 uF capacitor. Reverse the AC plug at the AC outlet and repeat the AC voltage measurements for each exposed metallic part.

The measured voltage must not exceed 0.3V RMS. This corresponds to 0.5mA AC. Any value exceeding this limit constitutes a potential shock hazard and must be corrected immediately.

The resistance measurement should be done between accessible exposed metal parts and power cord plug prongs with the power switch "ON". The resistance should be more than 6M ohms.

PRODUCT SAFETY NOTICE

Many electrical and mechanical parts in this monitor have special safety-related characteristics. These characteristics are offer passed unnoticed by visual spection and the protection afforded by them cannot necessarily be obtained by using replacement components rates for a higher voltage, wattage, etc. The replacement parts which have these special safety characteristics are identified by \triangle marks on the schematic diagram and on the parts list. Before replacing any of these components, read the parts list in this manual carefully. The use of substitute replacement parts which do not have the same safety characteristics as specified in the parts list may create shock, fire, X-RAY RADIATION or other hazards.



No image or badly distorted image with horizontal and/or vertical lines static lines. Symptom may have four boxes in each of the corners of the screen.



Procedure Instructions

There are 5 capacitors on the main PCB that have been identified as the primary cause of this symptom. Replace the capacitors in location #'s on the Main PCB - C-280 C-301, C-302, C-320 and C-323/ surface mounted 100UF 35 VOLTS. For warranty claims, list work as RPRE on the claim and list the cost of the caps to the "shipping" section of the claim for proper processing.

1.Do not power on .

1.1 Please check AC cable if connect to AC plug.

Is true the connector don't connect to AC plug. Please connect it.

1.2 Please check AC cable if connect to AC power.

Is true the AC cable don't connect to AC power. Please connect it.

1.3 Please check power board of fuse if broken.

If the F1 fuse is broken, Please pull out the AC cable from AC power. Please check AC L power and AC N ground by multimeter, The read number is infinite, the fuse is broke. then look up power board if not burn out place. Is true it. Please change power board or be changed power board.

2. The power on switch of green extinguish.

2.1 The power of led(indicator light) is red light, To touch power on key when indicator light wink.

Is true that the power DC output have somewhere short circuit.

3.The power is normal work ,but don't backlight.

3.1 The indicator light work normal (green light).

Please refer to attached sheet A circuit diagram.

3.2 Please check backlight of connector if not it direction is wrong or the connector of wire compositor direction is wrong.

3.3 To check connector panel of voltage is +24v. It's true. Then to check of the first pin if it

have +5V voltage, It's true, than to check power board of +24v voltage, It's true. The panel of backlight board is fail. The change panel of backlight board.

Please refer to attached sheet B Panel of datasheet.

4.The screen don't have picture But have backlight.

4.1 To check to panel of voltage , to check Main Board IC N031 the 5 pin of voltage is +12v.

If not, check the +12v power.

Please refer to attached sheet A circuit diagram.

5.The remote control don't be control.

5.1 The check batteries of remote control if it run out of .

5.2 To check main board of connecter X014 of wire connect fastness and the connecter of wire open.

Please refer to attached sheet A circuit diagram.

6.The sound don't output.

6.1 To check main board +24v voltage of connector X032, It's true not +24v voltage. Then to to check power main +24v fail .

Please refer to attached sheet A circuit diagram.

Product Specification

Product Model:	LCT42Z6TM
Screen Size:	42" diagonal
Screen Area:	930.24mm(H) x 531.26mm(V)
Aspect Ratio:	16:9
External Size:	1067.3mm(W) x 781.2mm(H) x 275.0mm(D) (with Stand)
	1067.3mm(W) x 732.3mm(H) x 117.0mm(D) (w/o Stand)
Net Weight:	27.5kg (with Stand)
Resolution:	1920 (H) x 1080 (V) pixels (Each pixel has R/G/B 3 color cells)
Pixel Dot Pitch:	0.4845mm(H) x 0.4845mm(V)
Color:	16.7 millions of colors (R/G/B each 256 scales)
Gray Scale:	256 (R/G/B each 8-bit)
Brightness(Peak Value):	500cd/m ²
Contrast(Dark Room):	800:1
Color System:	PAL, NTSC
Sound Effect:	Acoustic Cinema Enhancement
Power Supply:	AC 120V, 60 Hz
Power Consumption:	300W
Input/Output Terminal:	HDMI (Ver1.1) connector x 1
	VGA (D-Sub 15 Pin) x 1
	Component Video - YPbPr x 2 RCA Terminals
	Video Input RCA Terminals x 1
	S-Video Input Mini Din 4 Pin Terminal x 1
	1 set of Stereo Audio Output Terminals (RCA, L&R)
	Stereo, Audio x 5

Support the Signal Mode

A. D-Sub Mode (VGA)

Resolution	Horizontal Frequency (KHz)	Vertical Frequency (Hz)
640 x 480	31.50	60.00
800 x 600	35.16	56.25
	37.90	60.32
1024 x 768	48.40	60.00
1280 x 1024	64.00	60.01

B. HDTV Mode (YPbPr)

Resolution	Horizontal Frequency (KHz)	Vertical Frequency (Hz)
480i	15.734	59.94
480p(720x480)	31.468	59.94
720p(1280x720)	37.50	50.00
	45.00	60.00
1080i(1920x1080)	33.75	60.00
1080P	68.00	60.00

C. HDMI Mode

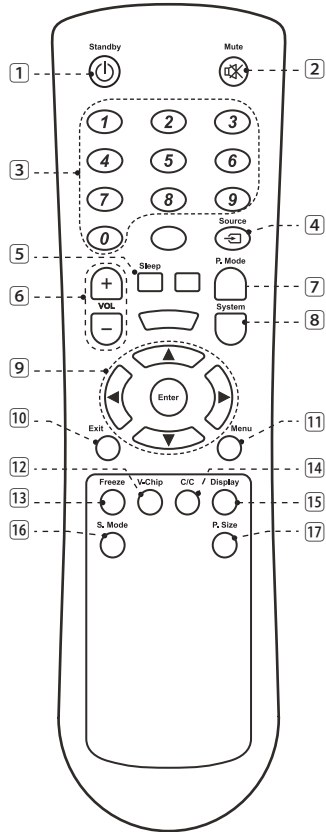
Resolution	Horizontal Frequency (KHz)	Vertical Frequency (Hz)
480p	31.468	59.94
720p	37.50	50.00
	45.00	60.00
1080i	28.125	50.00
	33.75	60.00
1080P	68.00	60.00

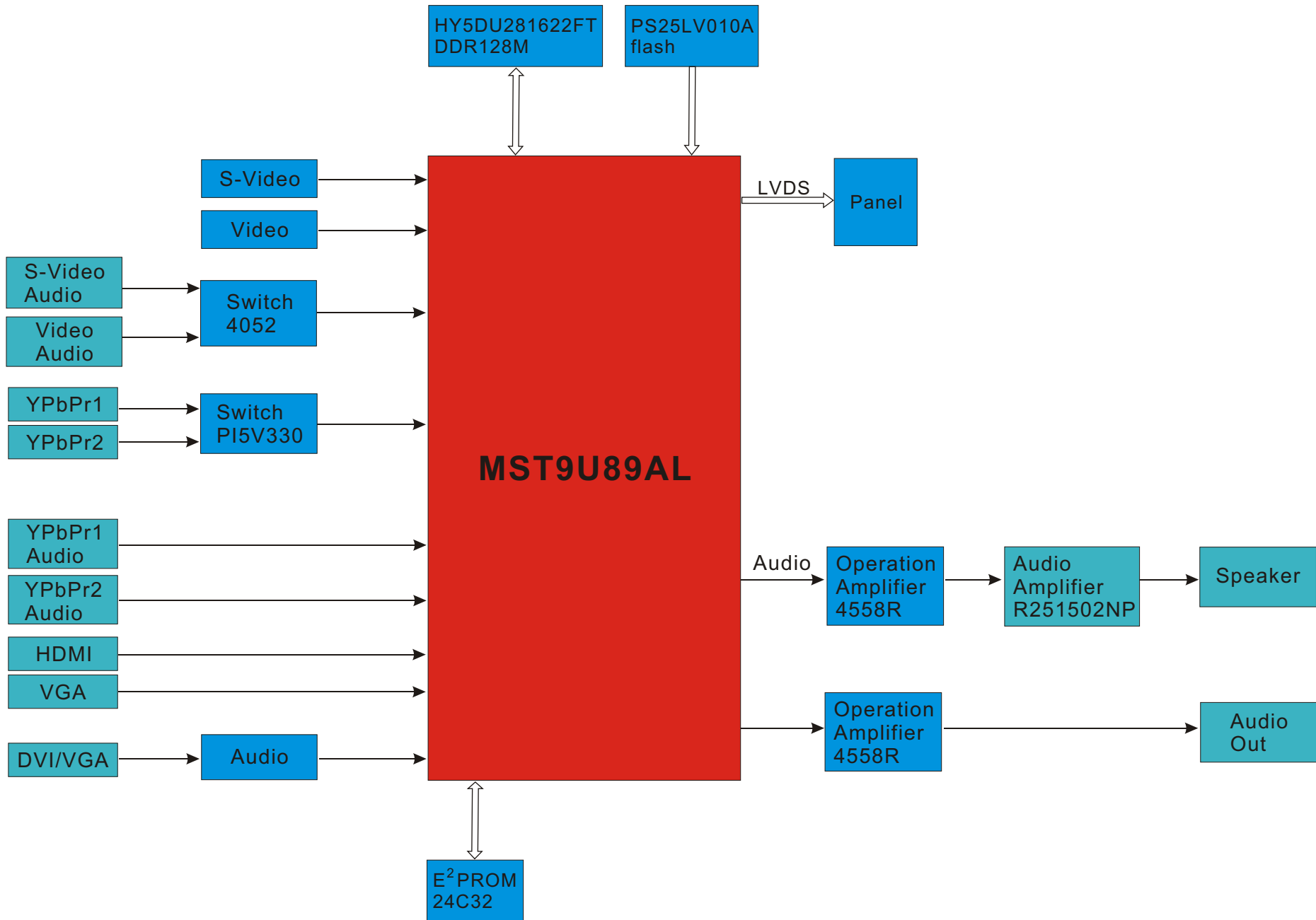
-When the signal received by the Display exceeds the allowed range, a warning message shall appear on the screen.

-You can confirm the input signal format from the on-screen.

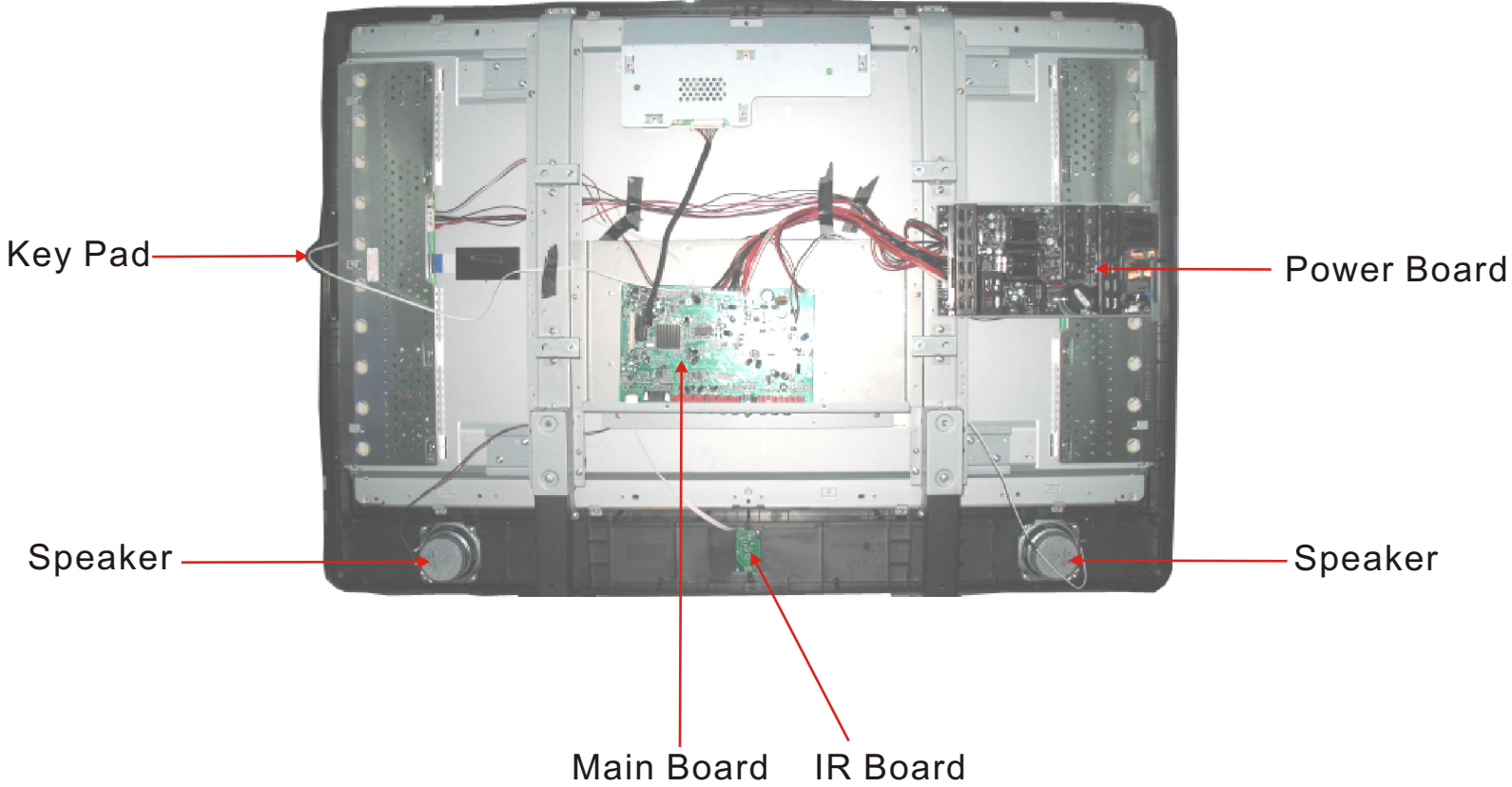
Remote Control

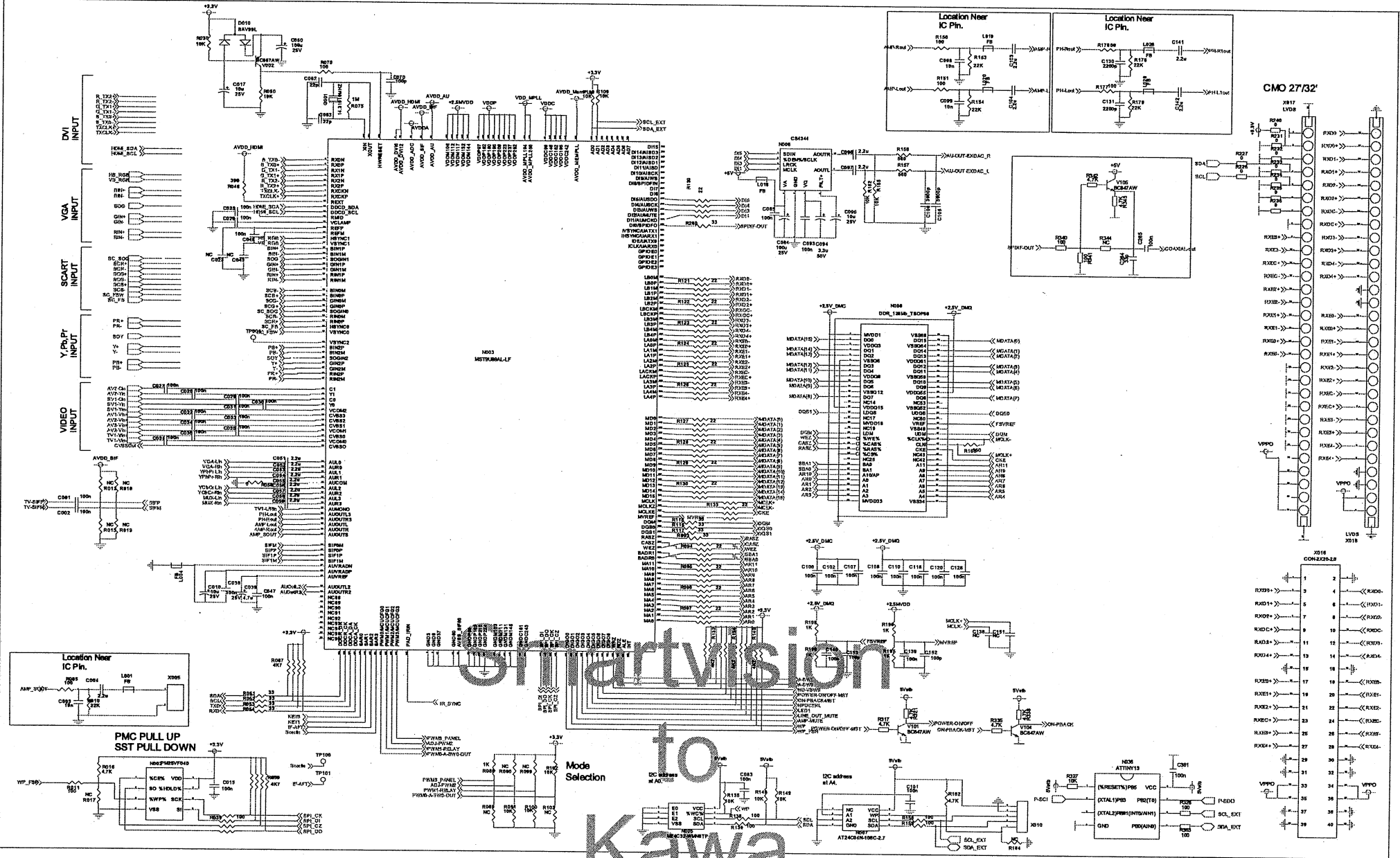
- 1 **Standby**(⏻): Press this button to turn off to standby and turn on from standby.
- 2 **Mute**(🔇): Press this button to quiet the sound system. Press again to reactivate the sound system.
- 3 **Number buttons**: Use these buttons to enter the password.
- 4 **Source**: Press this button and use ▲ / ▼ button to select the signal sources. VIDEO, S-VIDEO, YPbPr 1, YPbPr 2, VGA or HDMI.
- 5 **Sleep**: Press this button to select the sleep time, such as "15 Min, 30 Min, 45Min, 60 Min, 90 Min, 120 Min or Off".
- 6 **VOL +/-** : Press these buttons to increase or decrease the volume.
- 7 **P. Mode** : Press the button to select different picture effect, such as "Nature, Bright, User or Soft".
- 8 **System**: Press this button to select the color system, such as "PAL, NTSC or AUTO". (Only for VIDEO and S-VIDEO)
- 9 **Enter** : Press to enter or confirm.
 ◀ / ▶ : They are used as ◀ / ▶ buttons in the OSD Menu screen. ▶ also has enter function.
 ▲ / ▼ : They are used as ▲ / ▼ buttons in the OSD Menu screen.
- 10 **Exit**: Press this button to exit the OSD Menu.
- 11 **Menu**: Press this button to pop up the OSD Menu and press it again to exit the OSD Menu.
- 12 **V-Chip**: Press this button to enter the V-Chip Function. (Only for VIDEO and S-VIDEO)
- 13 **Freeze**: Press this button to hold on the screen. Press again to normal.
- 14 **C/C**: Press this button to change the CC mode. (Only for VIDEO and S-VIDEO)
- 15 **Display**: Press the button to display the source information.
- 16 **S. Mode**: Press the button to select different sound effect, such as "Normal, News, Music or User".
- 17 **P. Size**: Press this button, the picture will change according to Full, Zoom, Letter Box or 4:3. (Inactive for VGA)



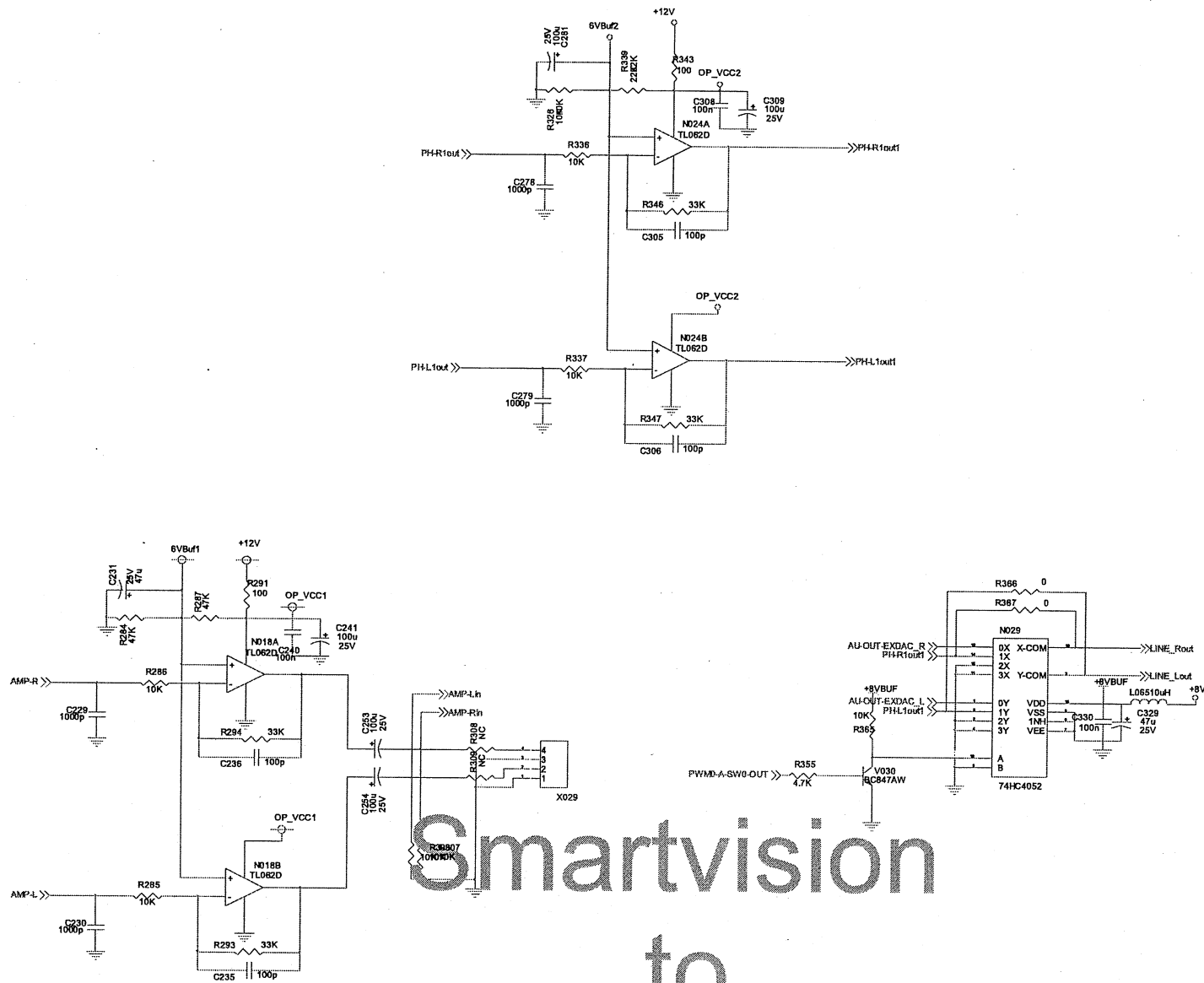


Parts position





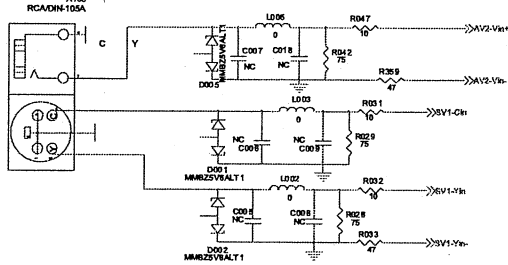
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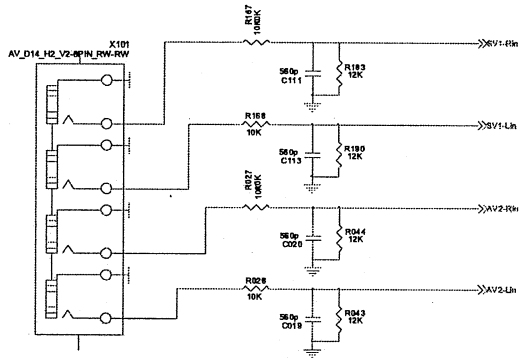
Near MST9688L PIN

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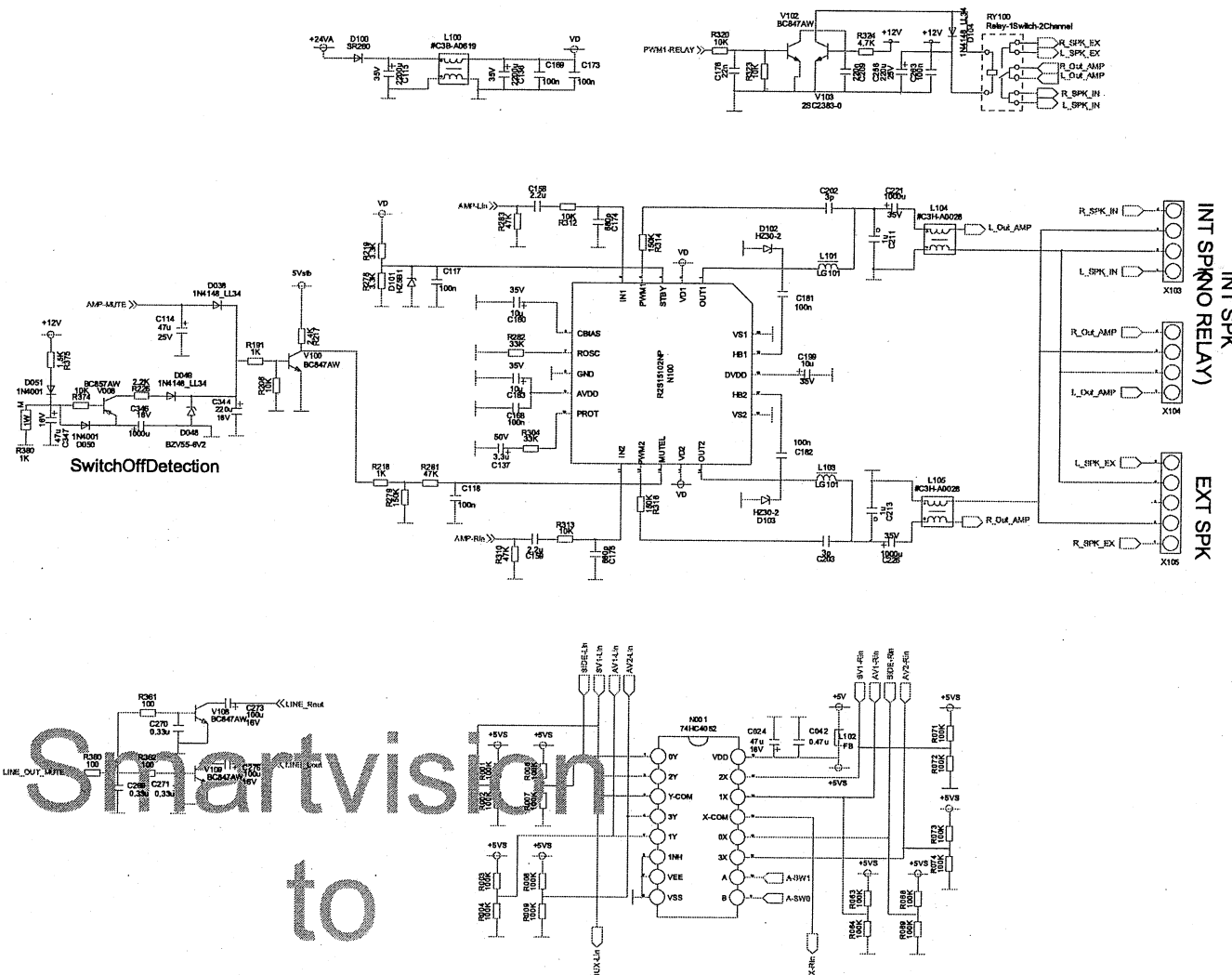
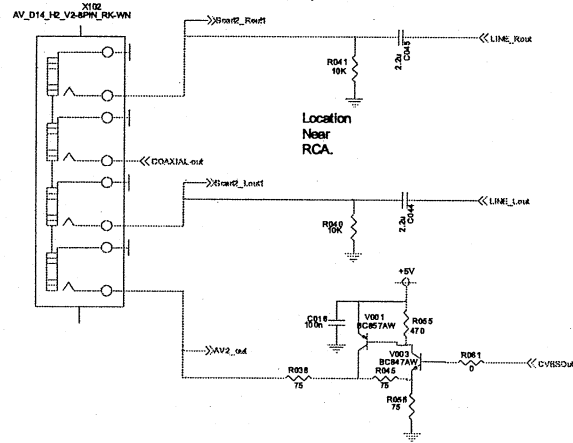
VIDEO S-VIDEO



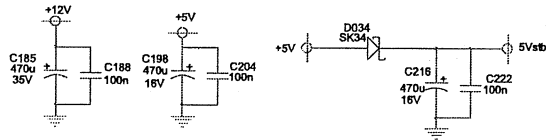
R-SV L-SV R-V L-V



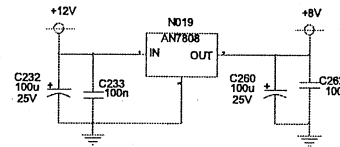
R-OUTCOAXIAL-OUT



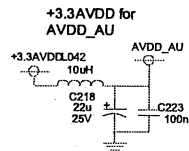
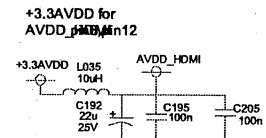
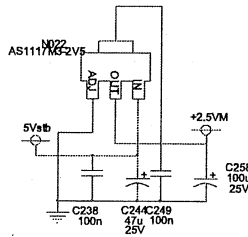
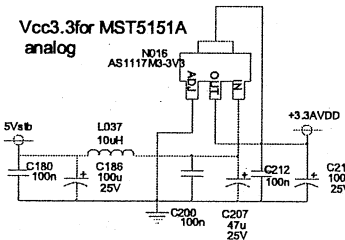
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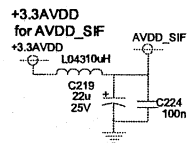
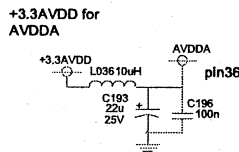
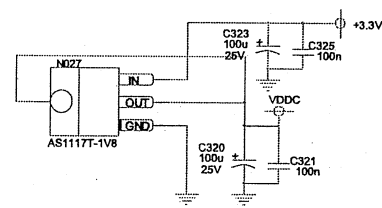
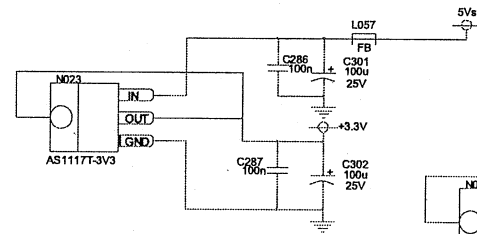
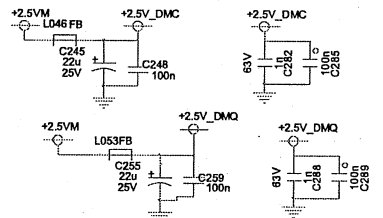
+8V for 74HC4052 SWITCH AUDIO



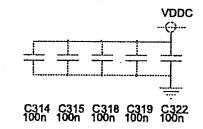
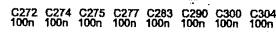
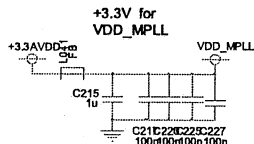
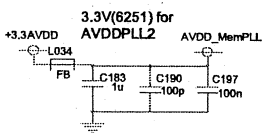
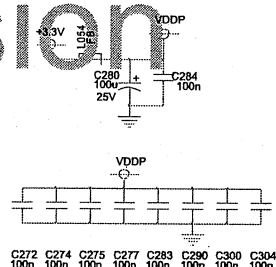
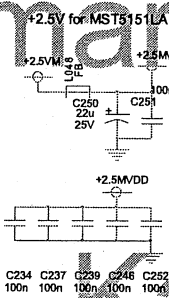
2.5V for MST5151A and DDRAM

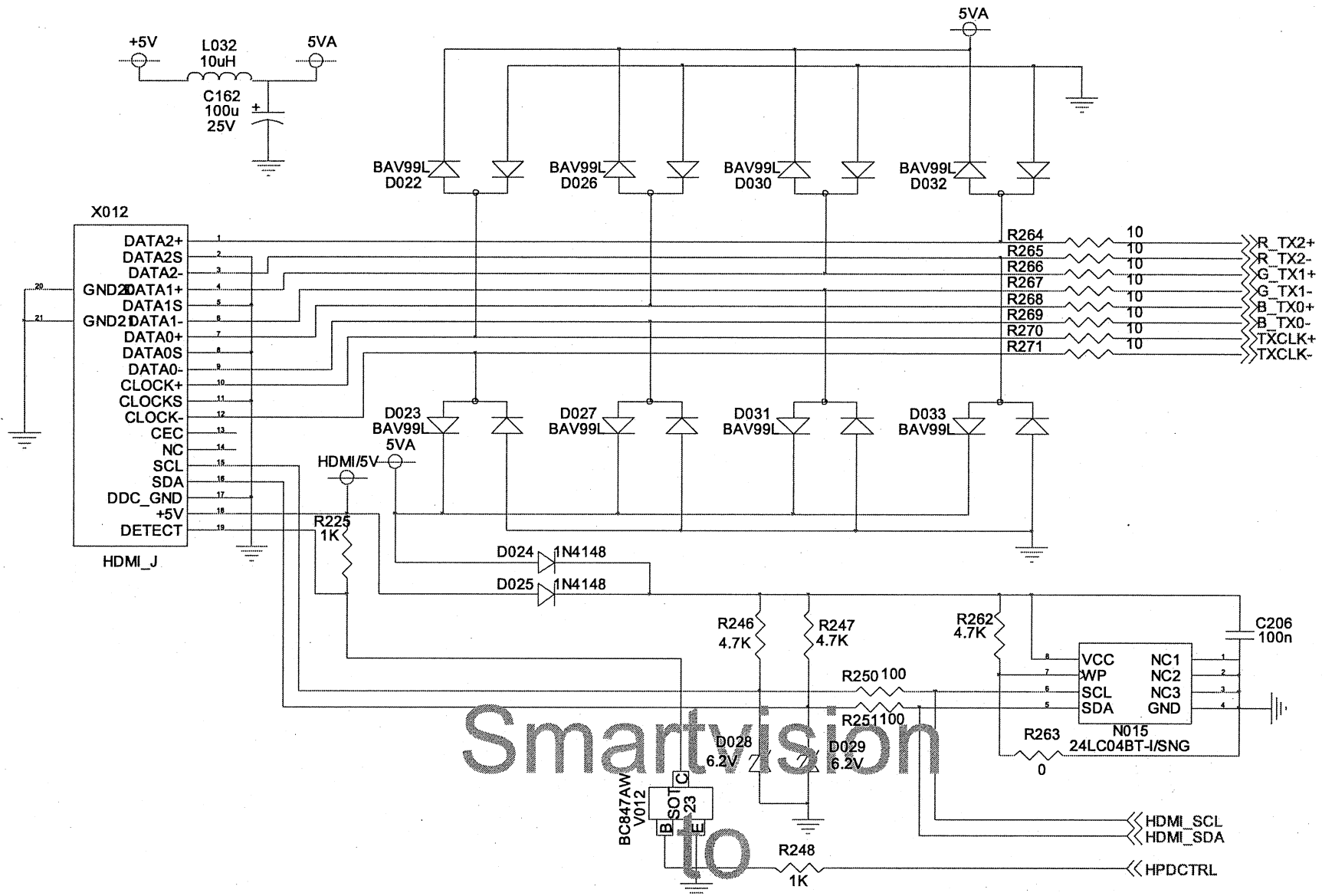


2.5V for DDRAM

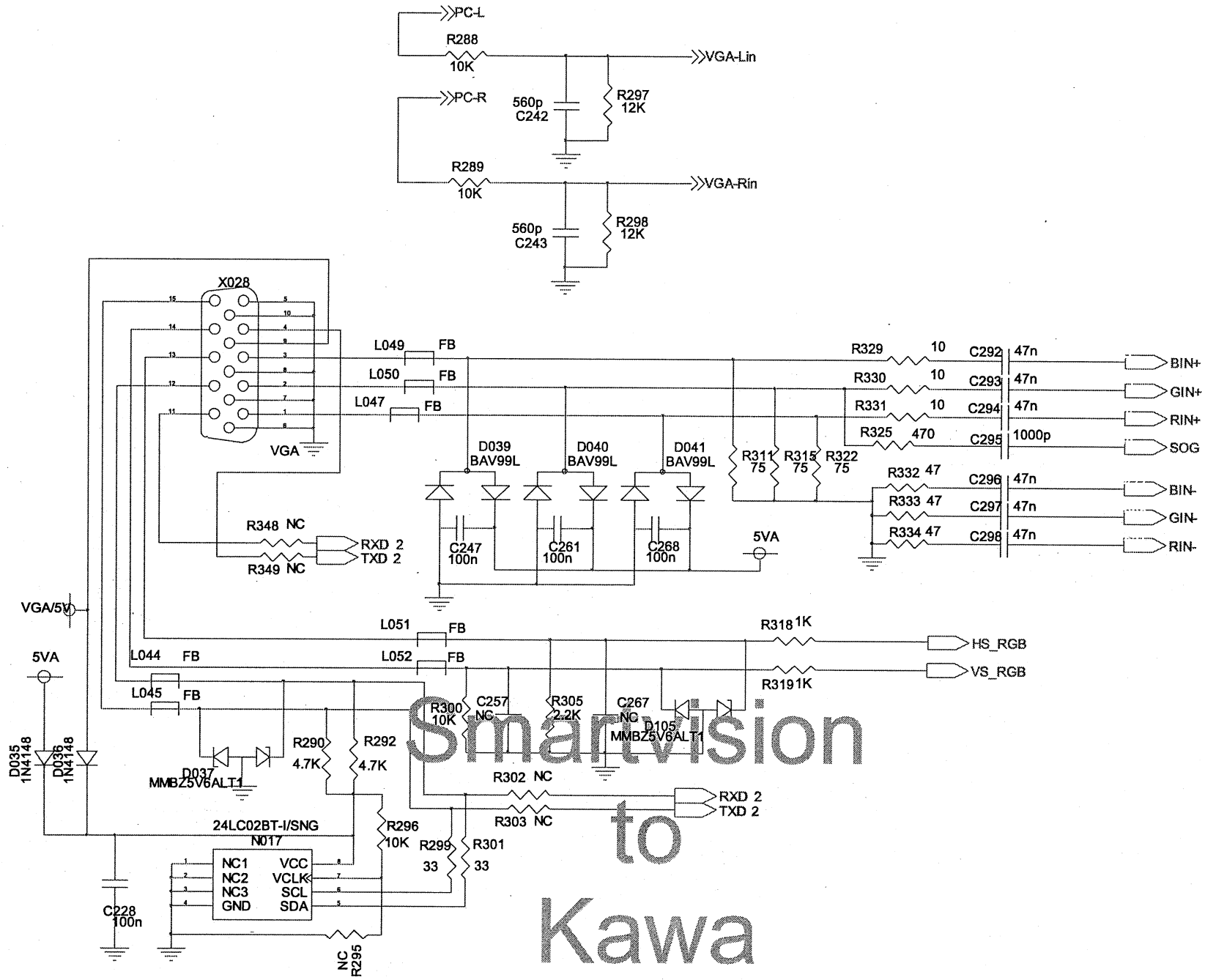


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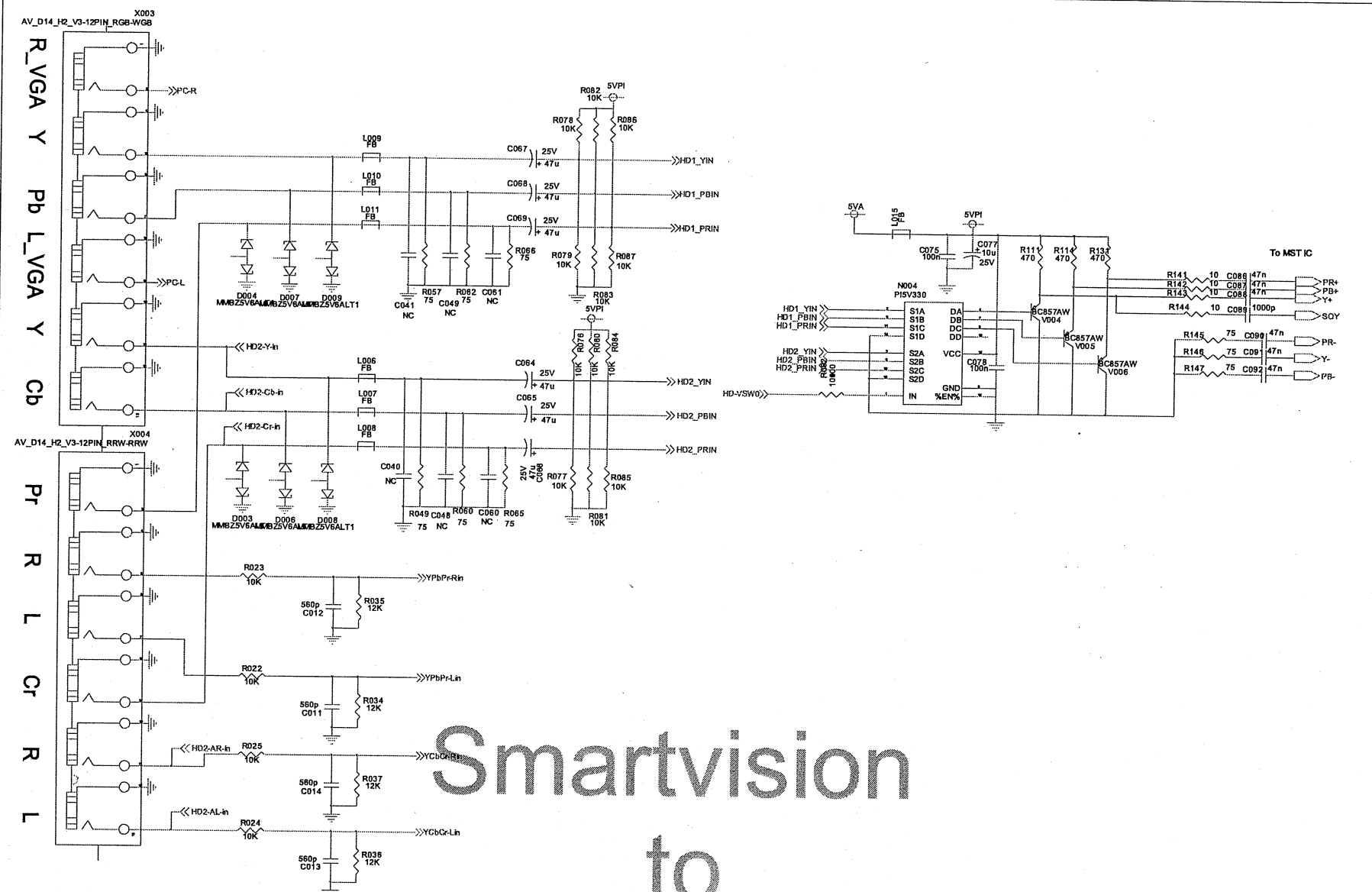




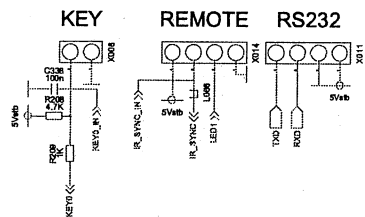
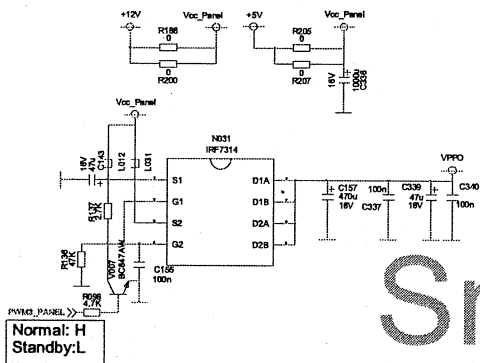
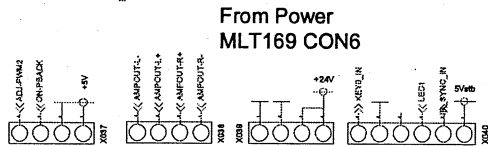
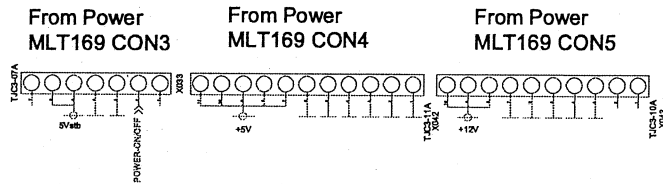
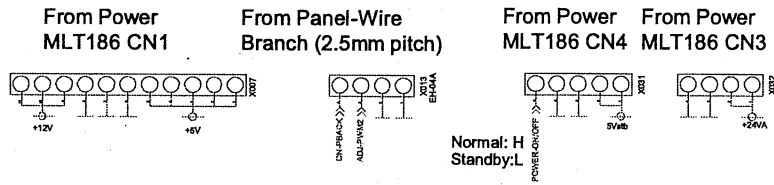
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	MLT169	MLT186	H'S P
X042	YES		
X031		YES	
X045			YES
X033	YES		
X043	YES		
X007		YES	
X040			YES/NO
X014	YES	YES	
X010	YES	YES	YES
X011	YES	YES	YES
X008	YES	YES	
X046			NO/YES
X037			YES
X013	YES	YES	
X039	YES		
X032		YES	
N033*			YES
N034*			YES
N035*			YES
X041			YES
X034			YES
X035			YES

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* INCLUDE DCDC'S IC'S RELATE COMPONETS:
 INDUCTOR X1
 DIODE X1
 CAPCITIOR X3/X4
 RESISTOR X2

Basic Operations & Circuit Description

MODULE

There are 1 pcs panel and 5 pcs PCB including 3 pcs Extension PCB, 1 pcs Timming controller board and 1 pcs Back Light board in the Module.

SET

There are 3 pcs PCBs including 1 pcs, 1 pcs keypad board, 1 pcs Remote Control Receiver board, 1 pcs Main(Video)board.

PCB funtion

1. Power :

(1). Input voltage: AC 120V, 60Hz.

(2). To provide power for PCBs.

2. Main board : To converter, S signals, AV signals, Y Pb/Cb Pr/Cr signals, DVI/HDMI signals and D-SUB signals to digital ones and to dealing with the digital signal for output to panel.

PCB failure analysis

1. POWER : NO picture, no power output.
2. Back Light :
 - a. No picture.
 - b. Flash on screen.
 - c. Darker picture with signals.

Main IC Specifications

- HDTV Controller with Video Decoder & 10-bit Dual LVDS Transmitter

FEATURES

- LCD TV controller with PIP/POP display functions
- Input supports up to SXGA & 1080P
- Panel supports up to full HD panels (1920x1080)
- TV decoder with 3-D comb filter
- Multi-Standard TV sound demodulator and decoder
- 10-bit triple-ADC for TV and RGB/YPbPr
- 10-bit video data processing
- Integrated DVI/HDCP/HDMI compliant receiver
- High-quality dual scaling engines & 3-D video de-interlacers
- Full function PIP/PBP/POP ^{Note}
- MStarACE-3 picture/color processing engine
- Embedded On-screen display controller (OSD) engine
- Built-in MCU supports PWM & GPIO
- Built-in dual-link 8/10-bit LVDS transmitter
- 5 Volt tolerant inputs
- Low EMI and power saving features
- 256-pin LQFP
- **NTSC/PAL/SECAM Video Decoder**
 - Supports NTSC M, NTSC-J, NTSC-4.43, PAL (B,D,G,H,M,N,I,Nc), and SECAM
 - Automatic TV standard detection
 - Motion adaptive 3-D comb filter for NTSC/PAL
 - 8 configurable CVBS & Y/C S-video inputs
 - Supports Closed-caption and V-chip
 - Macrovision detection
 - CVBS video output
- **Multi-Standard TV Sound Decoder**
 - Supports BTSC/A2/EIA-J demodulation and decoding
 - FM stereo & SAP demodulation
 - L/Rx4, mono, and SIF audio input
 - L/R loudspeaker and line outputs
 - Supports sub-woofer output
 - Built-in audio output DAC's
 - Audio processing for loudspeaker channel, including volume, balance, mute, tone, EQ, and virtual stereo/surround
- **Digital Audio Interface**
 - I²S digital audio input & output
 - S/PDIF digital audio input & output
 - HDMI audio channel processing capability
 - Programmable delay for audio/video synchronization
- **Analog RGB Compliant Input Ports**
 - Three analog ports support up to 150MHz
 - Supports PC RGB input up to SXGA@75Hz
 - Fast blanking and function selection switch support full SCART functions
 - Supports HDTV RGB/YPbPr/YCbCr up to 1080P
 - Supports Composite Sync and SOG (Sync-on-Green) separator
 - Automatic color calibration
- **DVI/HDCP/HDMI Compliant Input Port**
 - Operates up to 150 MHz (up to SXGA @75Hz)
 - Single link on-chip DVI 1.0 compliant receiver
 - High-bandwidth Digital Content Protection (HDCP) 1.1 compliant receiver
 - High Definition Multimedia Interface (HDMI) 1.2 compliant receiver
 - Long-cable tolerant robust receiving
 - Support HDTV up to 1080P
- **Auto-Configuration/Auto-Detection**
 - Auto input signal format and mode detection
 - Auto-tuning function including phasing, positioning, offset, gain, and jitter detection
 - Sync Detection for H/V Sync
- **Digital Video Input Port**
 - One 4:2:2 ITU-R BT.656 8/10-bit digital video input port
 - One 4:2:2 ITU-R BT.601 16-bit digital video input port
- **High-Performance Scaling Engine**
 - Fully Programmable shrink/zoom capabilities
 - Nonlinear video scaling supports various modes including Panorama
 - Supports keystone correction for projectors
- **Video Processing & Conversion**
 - 3-D motion adaptive video de-interlacers
 - Edge-oriented adaptive algorithm for smooth low-angle edges

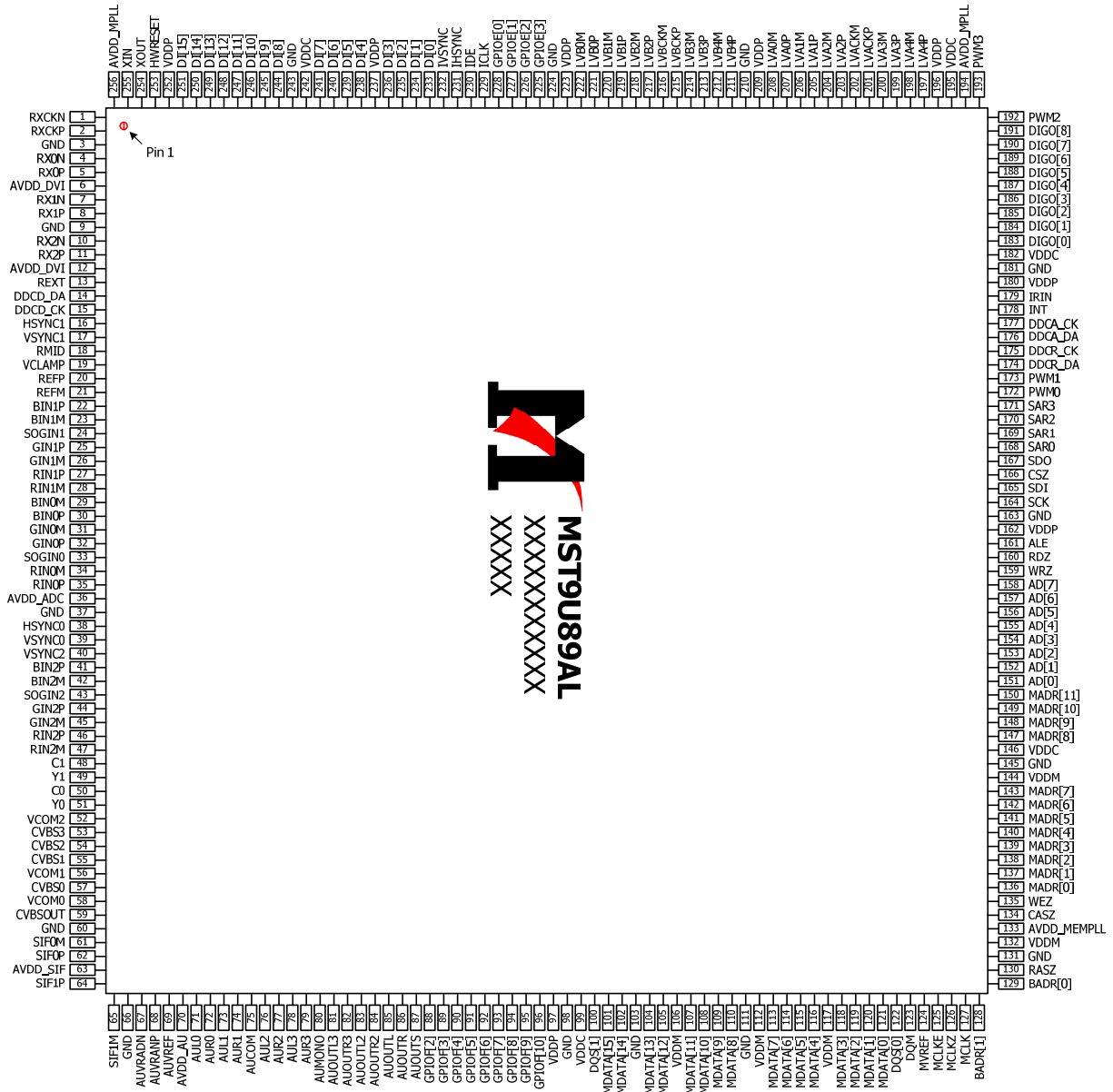
- Automatic 3:2 pull-down & 2:2 pull-down detection and recovery
- PIP/PBP/POP ^{Note} with programmable size and location, supports multi-video applications
- MStar 3rd Generation Advanced Color Engine (MStarACE-3) automatic picture enhancement gives:
 - Brilliant and fresh color
 - Intensified contrast and details
 - Vivid skin tone
 - Sharp edge
 - Enhanced depth of field perception
 - Accurate and independent color control
- sRGB compliance allows end-user to experience the same colors as viewed on CRTs and other displays
- Programmable 12-bit RGB gamma CLUT
- 3-D video noise reduction
- Frame rate conversion
- **On-Screen OSD Controller**
 - 16/256 color palette
 - 256/512 1-bit/pixel font
 - 128/256 4-bit/pixel font
 - Supports texture function
 - Supports 4K attribute/code
 - Horizontal and vertical stretch of OSD menus
 - Pattern generator for production test
 - Supports OSD MUX and alpha blending capability
 - Supports blinking and scrolling for closed caption applications
- **LVDS/TTL Panel Interface**
 - Supports 8/10-bit dual link LVDS up to full HD panel (1920x1080)
 - Supports 8-bit single TTL panel
 - Supports 2 data output formats: Thine & TI data mappings
 - Compatible with TIA/EIA
 - With 6/8 bits options
 - Reduced swing for LVDS for low EMI
 - Supports flexible spread spectrum frequency with 360Hz~11.8MHz and up to 25% modulation
- **Integrated Micro Controller**
 - Embedded 8032 micro controller
 - Configurable PWM's and GPIO's
 - Low-speed ADC inputs for system control
 - SPI bus for external flash
 - Supports external MCU option controlled through 4-wire double-data-rate direct MCU bus or 8-bit direct MCU bus
- **External Connection/Component**
 - 16-bit data bus for external frame buffer (SDR or DDR DRAM)
 - All system clocks synthesized from a single external clock

Note:
Availability of 3D video processing in some PIP/POP combinations is dependent on the selected DRAM speed and panel resolution.

GENERAL DESCRIPTION

The MST9U89AL is a high performance and fully integrated IC for multi-function LCD monitor/TV with resolutions up to full HD (1920x1080). It is configured with an integrated triple-ADC/PLL, an integrated DVI/HDCP/HDMI receiver, a multi-standard TV video and audio decoder, two video de-interlacers, two scaling engines, the MStarACE-3 color engine, an on-screen display controller, an 8-bit MCU and a built-in output panel interface. By use of external frame buffer, PIP/POP is provided for multimedia applications. Furthermore, 3-D video decoding and processing are fulfilled for high-quality TV applications. To further reduce system costs, the MST9U89AL also integrates intelligent power management control capability for green-mode requirements and spread-spectrum support for EMI management.

PIN DIAGRAM (MST9U89AL)



Note 1: This pin diagram is based LVDS output. For details, please see the Output Type vs. Pin Configuration at the end of Pin Description section.

PIN DESCRIPTION

MCU Interface

Pin Name	Pin Type	Function	Pin
HWRESET	Schmitt Trigger Input w/ 5V-tolerant	Hardware Reset, active high	253
ALE	I/O w/ 5V-tolerant	MCU Bus ALE, active high / General Purpose Input/Output (GPIOC[10])	161
RDZ	I/O w/ 5V-tolerant	MCU Bus RDZ, active low / General Purpose Input/Output (GPIOC[9])	160
WRZ	I/O w/ 5V-tolerant	MCU Bus WDZ, active low / General Purpose Input/Output (GPIOC[8])	159
INT	I/O w/ 5V-tolerant	MCU Bus Interrupt; 4mA driving strength / General Purpose Output (GPIOD[12])	178
AD[7:0]	I/O w/ 5V-tolerant	8051 bus AD[7:0]; 4mA driving strength / External Flash/RAM Data Bus (FLSHD[7:0]) / General Purpose Input/Output (GPIOC[7:0])	158-151

Analog Interface

Pin Name	Pin Type	Function	Pin
RMID		Mid-Scale Voltage Bypass	18
VCLAMP		CVBS/YC Mode Clamp Voltage Bypass	19
REFP		Internal ADC Top De-coupling Pin	20
REFM		Internal ADC Bottom De-coupling Pin	21
REXT	Analog Input	External Resister 390 ohm to AVDD_DVI	13
HSYNC0	Schmitt Trigger Input w/ 5V-tolerant	Analog HSYNC Input from Channel 0 / Function Select Switch Input from Channel 0 (FSSW0)	38
VSYNC0	Schmitt Trigger Input w/ 5V-tolerant	Analog VSYNC Input from Channel 0 / Fast Blanking Input from Channel 0 (FBLK0)	39
BIN0M	Analog Input	Reference Ground for Analog Blue Input from Channel 0	29
BIN0P	Analog Input	Analog Blue Input from Channel 0	30
GIN0M	Analog Input	Reference Ground for Analog Green Input from Channel 0	31
GIN0P	Analog Input	Analog Green Input from Channel 0	32
SOGIN0	Analog Input	Sync On Green Input from Channel 0	33
RIN0M	Analog Input	Reference Ground for Analog Red Input from Channel 0	34
RIN0P	Analog Input	Analog Red Input from Channel 0	35
HSYNC1	Schmitt Trigger Input w/ 5V-tolerant	Analog HSYNC Input from Channel 1 / Function Select Switch Input from Channel 1 (FSSW1)	16

Pin Name	Pin Type	Function	Pin
VSYNC1	Schmitt Trigger Input w/ 5V-tolerant	Analog VSYNC Input from Channel 1 / Fast Blanking Input from Channel 1 (FBLK1)	17
BIN1M	Analog Input	Reference Ground for Analog Blue Input from Channel 1	23
BIN1P	Analog Input	Analog Blue Input from Channel 1	22
SOGIN1	Analog Input	Sync On Green Input from Channel 1	24
GIN1M	Analog Input	Reference Ground for Analog Green Input from Channel 1	26
GIN1P	Analog Input	Analog Green Input from Channel 1	25
RIN1M	Analog Input	Reference Ground for Analog Red Input from Channel 1	28
RIN1P	Analog Input	Analog Red Input from Channel 1	27
BIN2M	Analog Input	Reference Ground for Analog Blue Input from Channel 2	42
BIN2P	Analog Input	Analog Blue Input from Channel 2	41
VSYNC2	Schmitt Trigger Input w/ 5V-tolerant	Analog VSYNC Input from Channel 2 / Fast Blanking Input from Channel 2 (FBLK2)	40
SOGIN2	Analog Input	Sync On Green Input from Channel 2 / Function Select Switch input from Channel 2 (FSSW2)	43
GIN2M	Analog Input	Reference Ground for Analog Green Input from Channel 2	45
GIN2P	Analog Input	Analog Green Input from Channel 2	44
RIN2M	Analog Input	Reference Ground for Analog Red Input from Channel 2	47
RIN2P	Analog Input	Analog Red Input from Channel 2	46

Analog Video Input/Output Interface

Pin Name	Pin Type	Function	Pin
C1	Analog Input	Chroma Video Input 1 / CVBS Input Channel 7 (CVBS7)	48
Y1	Analog Input	Luma Video Input 1 / CVBS Input Channel 5 (CVBS5)	49
C0	Analog Input	Chroma Video Input 0 / CVBS Input Channel 6 (CVBS6)	50
Y0	Analog Input	Luma Video Input 0 / CVBS Input Channel 4 (CVBS4)	51
VCOM2	Analog Input	YC Video Input Reference Ground	52
VCOM1	Analog Input	CVBS1, CVBS2, CVBS3 Video Input Reference Ground	56
VCOM0	Analog Input	CVBS0 Video Input Reference Ground	58
CVBS3	Analog Input	CVBS (Composite) Video Input Channel 3	53
CVBS2	Analog Input	CVBS (Composite) Video Input Channel 2	54
CVBS1	Analog Input	CVBS (Composite) Video Input Channel 1	55

Pin Name	Pin Type	Function	Pin
CVBS0	Analog Input	CVBS (Composite) Video Input Channel 0	57
CVBSOUT	Analog Output	CVBS (Composite) Video Output	59

Analog Audio Input/Output Interface

Pin Name	Pin Type	Function	Pin
SIF0M	Analog Input	Reference Ground for SIF Audio Input Channel 0	61
SIF0P	Analog Input	SIF Audio Input Channel 0	62
SIF1P	Analog Input	SIF Audio Input Channel 1	64
SIF1M	Analog Input	Reference Ground for SIF Audio Input Channel 1	65
AUVRADN		Negative Reference Ground for Audio ADC	67
AUVRADP		Positive Reference Voltage for Audio ADC	68
AUVREF		Reference Voltage for Audio Common Mode	69
AUL0	Analog Input	Audio Line Input Left Channel 0	71
AUR0	Analog Input	Audio Line Input Right Channel 0	72
AUL1	Analog Input	Audio Line Input Left Channel 1	73
AUR1	Analog Input	Audio Line Input Right Channel 1	74
AUCOM	Analog Input	Reference Ground for Audio Line Input	75
AUL2	Analog Input	Audio Line Input Left Channel 2	76
AUR2	Analog Input	Audio Line Input Right Channel 2	77
AUL3	Analog Input	Audio Line Input Left Channel 3	78
AUR3	Analog Input	Audio Line Input Right Channel 3	79
AUMONO	Analog Input	Mono Audio Input	80
AUOUTL3	Analog Output	Main Audio Output Left Channel 3	81
AUOUTR3	Analog Output	Main Audio Output Right Channel 3	82
AUOUTL2	Analog Output	Main Audio Output Left Channel 2	83
AUOUTR2	Analog Output	Main Audio Output Right Channel 2	84
AUOUTL	Analog Output	Main Audio Output Left Channel	85
AUOUTR	Analog Output	Main Audio Output Right Channel	86
AUOUTS	Analog Output	Main Audio Sub-Woofer Channel	87

DVI/HDMI Interface

Pin Name	Pin Type	Function	Pin
RX0N	Input	DVI/HDMI Channel 0 Negative Data Input	4
RX0P	Input	DVI/HDMI Channel 0 Positive Data Input	5
RX1N	Input	DVI/HDMI Channel 1 Negative Data Input	7

Pin Name	Pin Type	Function	Pin
RX1P	Input	DVI/HDMI Channel 1 Positive Data Input	8
RX2N	Input	DVI/HDMI Channel 2 Negative Data Input	10
RX2P	Input	DVI/HDMI Channel 2 Positive Data Input	11
RXCKN	Input	DVI/HDMI Negative Clock Input	1
RXCKP	Input	DVI/HDMI Positive Clock Input	2

LVDS Interface ^{Note 1}

Pin Name	Pin Type	Function	Pin
LVA0M	Output	LVDS A-Link Channel 0 Negative Data Output	208
LVA0P	Output	LVDS A-Link Channel 0 Positive Data Output	207
LVA1M	Output	LVDS A-Link Channel 1 Negative Data Output	206
LVA1P	Output	LVDS A-Link Channel 1 Positive Data Output	205
LVA2M	Output	LVDS A-Link Channel 2 Negative Data Output	204
LVA2P	Output	LVDS A-Link Channel 2 Positive Data Output	203
LVA3M	Output	LVDS A-Link Channel 3 Negative Data Output	200
LVA3P	Output	LVDS A-Link Channel 3 Positive Data Output	199
LVA4M	Output	LVDS A-Link Channel 3 Negative Data Output	198
LVA4P	Output	LVDS A-Link Channel 3 Positive Data Output	197
LVACKM	Output	LVDS A-Link Negative Clock Output	202
LVACKP	Output	LVDS A-Link Positive Clock Output	201
LVB0M	Output	LVDS B-Link Channel 0 Negative Data Output	222
LVB0P	Output	LVDS B-Link Channel 0 Positive Data Output	221
LVB1M	Output	LVDS B-Link Channel 1 Negative Data Output	220
LVB1P	Output	LVDS B-Link Channel 1 Positive Data Output	219
LVB2M	Output	LVDS B-Link Channel 2 Negative Data Output	218
LVB2P	Output	LVDS B-Link Channel 2 Positive Data Output	217
LVB3M	Output	LVDS B-Link Channel 3 Negative Data Output	214
LVB3P	Output	LVDS B-Link Channel 3 Positive Data Output	213
LVB4M	Output	LVDS B-Link Channel 3 Negative Data Output	212
LVB4P	Output	LVDS B-Link Channel 3 Positive Data Output	211
LVBCKM	Output	LVDS B-Link Negative Clock Output	216
LVBCKP	Output	LVDS B-Link Positive Clock Output	215

Note 1: Please see the Output Type vs. Pin Configuration at the end of Pin Description section.

TTL Interface **Note 1**

Pin Name	Pin Type	Function	Pin
LCK	Output w/ Pull-down Resistor	LCD Output Clock; 6mA driving strength	225
LDE	Output w/ Pull-down Resistor	LCD Data Enable Output; 6mA driving strength	226
LHSYNC	Output w/ Pull-down Resistor	LCD HSYNC; 6mA driving strength	227
LVSYNC	Output w/ Pull-down Resistor	LCD VSYNC; 6mA driving strength	228
RA[7:0]	Output w/ Pull-down Resistor	Port A Red Channel Bit[7:0]; 6mA driving strength	222-215
GA[7:0]	Output w/ Pull-down Resistor	Port A Green Channel Bit[7:0]; 6mA driving strength	214-211, 208-205
BA[7:0]	Output w/ Pull-down Resistor	Port A Blue Channel Bit[7:0]; 6mA driving strength	204-197

Note 1: Please see the Output Type vs. Pin Configuration at the end of Pin Description section.

Serial Flash Interface

Pin Name	Pin Type	Function	Pin
SCK	I/O w/ 5V-tolerant	SPI Flash Serial Clock / General Purpose Input/Output (GPIO[14])	164
SDI	I/O w/ 5V-tolerant	SPI Flash Serial Data Input (Output Pin) / General Purpose Input/Output (GPIO[15])	165
CSZ	I/O w/ 5V-tolerant	SPI Flash Chip select / General Purpose Input/Output (GPIO[16])	166
SDO	I/O w/ 5V-tolerant	SPI Flash Serial Data Output (Input Pin) / General Purpose Input/Output (GPIO[17])	167

GPIO Interface ^{Note 2}

Pin Name	Pin Type	Function	Pin
GPIOE[3:0]	I/O (not 5V-tolerant)	General Purpose Input/Output (GPIOE[3:0])	225-228
GPIOF[10:2]	I/O w/ 5V-Tolerant	General Purpose Input/Output (GPIOF[10:2])	96-88
SAR3	I/O (not 5V-tolerant)	SAR Low Speed ADC Input 3 / General Purpose Input/Output (GPIOD[3])	171
SAR2	I/O (not 5V-tolerant)	SAR Low Speed ADC Input 2 / General Purpose Input/Output (GPIOD[2])	170
SAR1	I/O (not 5V-tolerant)	SAR Low Speed ADC Input 1 / General Purpose Input/Output (GPIOD[1])	169
SAR0	I/O (not 5V-tolerant)	SAR Low Speed ADC Input 0 / General Purpose Input/Output (GPIOD[0])	168
PWM3	I/O w/ 5V-Tolerant	Pulse Width Modulation Output 3; 4mA driving strength / General Purpose Output (GPIOD[7])	193
PWM2	I/O w/ 5V-Tolerant	Pulse Width Modulation Output 2; 4mA driving strength / General Purpose Output (GPIOD[6])	192
PWM1	I/O w/ 5V-Tolerant	Pulse Width Modulation Output 1; 4mA driving strength / General Purpose Output (GPIOD[5])	173
PWM0	I/O w/ 5V-Tolerant	Pulse Width Modulation Output 0; 4mA driving strength / General Purpose Output (GPIOD[4])	172
IRIN	I/O w/ 5V-tolerant	IR Receiver Input / General Purpose Output (GPIOD[13])	179
DIGO[8:6]	I/O w/ 5V-tolerant	General Purpose Input/Output (GPIOB[8:6])	191-189
DIGO[5]	I/O w/ 5V-tolerant	General Purpose Input/Output (GPIOB[5]) / Universal Asynchronous Transmitter 1 (UART1_TX)	188
DIGO[4]	I/O w/ 5V-tolerant	General Purpose Input/Output (GPIOB[4]) / Universal Asynchronous Receiver 1 (UART1_RX)	187
DIGO[3]	I/O w/ 5V-tolerant	General Purpose Input/Output (GPIOB[3]) / Programmable as Audio Serial Data Output 0 (AUSD0)	186
DIGO[2]	I/O w/ 5V-tolerant	General Purpose Input/Output (GPIOB[2]) / Programmable as Audio Serial Clock Output (AUSCK)	185
DIGO[1]	I/O w/ 5V-tolerant	General Purpose Input/Output (GPIOB[1]) / Programmable as Word Select Output (AUWS)	184
DIGO[0]	I/O w/ 5V-tolerant	General Purpose Input/Output (GPIOB[0]) / Programmable as Audio Master Clock Output (AUMCKO)	183
ICLK	I/O w/ 5V-tolerant	Digital Input Clock / Universal Asynchronous Receiver 0 (UART0_RX) / General Purpose Input/Output (GPIOA[24])	229
IDE	I/O w/ 5V-tolerant	Digital Input DE / Universal Asynchronous Transmitter 0 (UART0_TX) /	230

Pin Name	Pin Type	Function	Pin
		General Purpose Input/Output (GPIOA[25])	
IHSYNC	I/O w/ 5V-tolerant	Digital Input HSYNC / Universal Asynchronous Receiver 1 (UART1_RX) / General Purpose Input/Output (GPIOA[26])	231
IVSYNC	I/O w/ 5V-tolerant	Digital Input VSYNC / Universal Asynchronous Transmitter 1 (UART1_TX) / General Purpose Input/Output (GPIOA[27])	232
DI[15:0] ^{Note 3}	I/O w/ 5V-tolerant	Video Digital Input Port / Digital Audio Port / General Purpose Input/Output (GPIOA[15:0])	251-244, 241-238, 236-233

Note 2: Please see Pin Configuration vs. Function at the end of Pin Description section.

Note 3: Please see Digital Video Input Format Table at the end of Pin Description section.

DRAM Interface

Pin Name	Pin Type	Function	Pin
MVREF	Input	Reference Voltage for DDR SDRAM Interface	124
MCLKE	Output	DRAM Memory Clock Enable	125
MCLKZ	Output	DRAM Memory Clock Complementary / Output (For Differential Clocks)	126
MCLK	Output	DRAM Memory Clock	127
BADR[1:0]	Output	DRAM Memory Bank Address	128, 129
RASZ	Output	Row Address Strobe, active low	130
CASZ	Output	Column Address Strobe, active low	134
WEZ	Output	Write Enable, active low	135
DQS[1:0]	Output	Data Strobe	100, 122
DQM	Output	Data Mask Byte Enable	123
MADR[11:0]	Output	DRAM Memory Address	150-147, 143-136
MDATA[15:0]	Input/Output	DRAM Memory Data Bus	101, 102, 104, 105, 107-110, 113-116, 118-121

Misc. Interface

Pin Name	Pin Type	Function	Pin
DDCD_DA	I/O w/ 5V-tolerant	HDCP Serial Bus Data / DDC Data of DVI Port	14
DDCD_CK	Input w/ 5V-tolerant	HDCP Serial Bus Clock / DDC Clock of DVI Port	15
DDCA_CK	I/O w/ 5V-tolerant	DDC Clock for Analog port / Universal Asynchronous Receiver 0 (UART0_RX)/ General Purpose Output (GPIOD[11])	177

Pin Name	Pin Type	Function	Pin
DDCA_DA	I/O w/ 5V-tolerant	DDC Data for Analog port / Universal Asynchronous Transmitter 0 (UART0_TX) / General Purpose Output (GPIOD[10])	176
DDCR_CK	I/O w/ 5V-tolerant	DDC Clock for ROM / General Purpose Output (GPIOD[9])	175
DDCR_DA	I/O w/ 5V-tolerant	DDC Data for ROM / General Purpose Output (GPIOD[8])	174
XIN	Crystal Oscillator Input	Crystal Oscillator Input	255
XOUT	Crystal Oscillator Output	Crystal Oscillator Output	254

Power Pins

Pin Name	Pin Type	Function	Pin
AVDD_DVI	3.3V Power	DVI/HDMI Power	6, 12
AVDD_ADC	3.3V Power	ADC Power	36
AVDD_SIF	3.3V Power	SIF Power	63
AVDD_AU	3.3V Power	Audio Power	70
AVDD_MEMPLL	3.3V Power	PLL Power	133
AVDD_MPLL	3.3V Power	PLL Power	194, 256
VDDM	3.3V Power (SDRAM) / 2.5V Power (DDR)	Memory Interface Power	106, 112, 117, 132, 144
VDDP	3.3V Power	Digital Output Power	97, 162, 180, 196, 209, 223, 237, 252
VDDC	1.8V Power	Digital Core Power	99, 146, 182, 195, 242
GND	Ground	Ground	3, 9, 37, 60, 66, 98, 103, 111, 131, 145, 163, 181, 210, 224, 243

Note 1:

Output Type vs. Pin Configuration

Pin #197-228	LVDS	TTL	Pin #197-228	LVDS	TTL
197	LVA4P	BA[0]	213	LVB3P	GA[6]
198	LVA4M	BA[1]	214	LVB3M	GA[7]
199	LVA3P	BA[2]	215	LVBCKP	RA[0]
200	LVA3M	BA[3]	216	LVBCKM	RA[1]
201	LVACKP	BA[4]	217	LVB2P	RA[2]
202	LVACKM	BA[5]	218	LVB2M	RA[3]
203	LVA2P	BA[6]	219	LVB1P	RA[4]
204	LVA2M	BA[7]	220	LVB1M	RA[5]
205	LVA1P	GA[0]	221	LVB0P	RA[6]
206	LVA1M	GA[1]	222	LVB0M	RA[7]
207	LVA0P	GA[2]	223	VDDP	VDDP
208	LVA0M	GA[3]	224	GND	GND
209	VDDP	VDDP	225	GPIOE[3]	LCK
210	GND	GND	226	GPIOE[2]	LDE
211	LVB4P	GA[4]	227	GPIOE[1]	LHSYNC
212	LVB4M	GA[5]	228	GPIOE[0]	LVSYNC

Note 2:

Pin Configuration vs. Function

Pin #88-96

Pin #	GPIOF ^{Note}	ITU656 Out (GPIOF_SEL=00)	ITU656 8-bit In (GPIOF_SEL=11) (VDO_PORT_SEL=10)	Audio (GPIOF_SEL=01) (AU_PAD_SWAP_F=0)	Audio (GPIOF_SEL=01) (AU_PAD_SWAP_F=1)	GPO (GPIOF_SEL=10)	GPI (GPIOF_SEL=11)
88	GPIOF[2]	VDO[0]	VDI[0]	AIWS		GPOF[2]	GPIF[2]
89	GPIOF[3]	VDO[1]	VDI[1]	AISCK	AU2MCKO	GPOF[3]	GPIF[3]
90	GPIOF[4]	VDO[2]	VDI[2]	AISD	AU2WS	GPOF[4]	GPIF[4]
91	GPIOF[5]	VDO[3]	VDI[3]	AUMCKO	AU2SCK	GPOF[5]	GPIF[5]
92	GPIOF[6]	VDO[4]	VDI[4]	AUWS	AU2SD[0]	GPOF[6]	GPIF[6]
93	GPIOF[7]	VDO[5]	VDI[5]	AUSCK	SPDIFI	GPOF[7]	GPIF[7]
94	GPIOF[8]	VDO[6]	VDI[6]	AUSD[0]	AUSD[1]	GPOF[8]	GPIF[8]
95	GPIOF[9]	VDO[7]	VDI[7]	AUMUTE	AUSD[2]	GPOF[9]	GPIF[9]
96	GPIOF[10]	VDOCLK	VDICLK	SPDIFO	AUSD[3]	GPOF[10]	GPIF[10]

Note: The function of each pin can be selected individually.

Pin #233-241, #244-251

Pin #	Digital Video Input Data	Digital Audio I/O (AU_SWAP=0)	Digital Audio I/O (AU_SWAP=1)
233	DI[0]	SPDIFO	
234	DI[1]	AUMCKO	
235	DI[2]	AUMUTE	
236	DI[3]	AUWS	
238	DI[4]	AUSCK	
239	DI[5]	AUSD	
240	DI[6]		
241	DI[7]		
244	DI[8]	SPDIFI	SPDIFO
245	DI[9]	AIWS	AUMCKO
246	DI[10]	AISCK	AUMUTE
247	DI[11]	AISD	AUWS
248	DI[12]		AUSCK
249	DI[13]		AUSD
250	DI[14]		
251	DI[15]	SPDIFO	

Audio Interface

Pin Name	Pin Type	Function
AUSD	Output	Audio Serial Data Output
AUSCK	Output	Audio Serial Clock Output
AUWS	Output	Audio Serial Word Select Output
AUMUTE	Output	Audio Output Mute Control
AUMCKO	Output	Audio Master Clock Output
SPDIFO	Output	Audio S/PDIF Output
AISCK	Input	Audio Serial Clock Input
AIWS	Input	Audio Word Select Input
AISD	Input	Audio Serial Data Input
SPDIFI	Input	Audio S/PDIF Audio Input

Note 3:**Digital Video Input Format Table**

Format	8-Bit ITU656		10-Bit ITU656		8-Bit ITU601			
YC Swap	X	X	X	X	0	0	1	1
ML Swap	0	1	0	1	0	1	0	1
ICLK	ICLK	ICLK	ICLK	ICLK	ICLK	ICLK	ICLK	ICLK
IDE					IDE	IDE	IDE	IDE
IHSYNC					IHSYNC	IHSYNC	IHSYNC	IHSYNC
IVSYNC					IVSYNC	IVSYNC	IVSYNC	IVSYNC
DI[0]	YCbCr[0]	YCbCr[7]	YCbCr[2]	YCbCr[7]	Y[0]	Y[7]	CbCr[0]	CbCr[7]
DI[1]	YCbCr[1]	YCbCr[6]	YCbCr[3]	YCbCr[6]	Y[1]	Y[6]	CbCr[1]	CbCr[6]
DI[2]	YCbCr[2]	YCbCr[5]	YCbCr[4]	YCbCr[5]	Y[2]	Y[5]	CbCr[2]	CbCr[5]
DI[3]	YCbCr[3]	YCbCr[4]	YCbCr[5]	YCbCr[4]	Y[3]	Y[4]	CbCr[3]	CbCr[4]
DI[4]	YCbCr[4]	YCbCr[3]	YCbCr[6]	YCbCr[3]	Y[4]	Y[3]	CbCr[4]	CbCr[3]
DI[5]	YCbCr[5]	YCbCr[2]	YCbCr[7]	YCbCr[2]	Y[5]	Y[2]	CbCr[5]	CbCr[2]
DI[6]	YCbCr[6]	YCbCr[1]	YCbCr[8]	YCbCr[1]	Y[6]	Y[1]	CbCr[6]	CbCr[1]
DI[7]	YCbCr[7]	YCbCr[0]	YCbCr[9]	YCbCr[0]	Y[7]	Y[0]	CbCr[7]	CbCr[0]
DI[8]			YCbCr[0]	YCbCr[9]	CbCr[0]	CbCr[7]	Y[0]	Y[7]
DI[9]			YCbCr[1]	YCbCr[8]	CbCr[1]	CbCr[6]	Y[1]	Y[6]
DI[10]					CbCr[2]	CbCr[5]	Y[2]	Y[5]
DI[11]					CbCr[3]	CbCr[4]	Y[3]	Y[4]
DI[12]					CbCr[4]	CbCr[3]	Y[4]	Y[3]
DI[13]					CbCr[5]	CbCr[2]	Y[5]	Y[2]
DI[14]					CbCr[6]	CbCr[1]	Y[6]	Y[1]
DI[15]					CbCr[7]	CbCr[0]	Y[7]	Y[0]

ELECTRICAL SPECIFICATIONS

Analog Interface Characteristics

Parameter	Min	Typ	Max	Unit
VIDEO ADC Resolution		10		Bits
DC ACCURACY				
Differential Nonlinearity		TBD	TBD	LSB
Integral Nonlinearity		TBD		LSB
VIDEO ANALOG INPUT				
Input Voltage Range				
Minimum			0.5	V p-p
Maximum	1.0			V p-p
Input Bias Current			1	uA
Input Full-Scale Matching		1.5		%FS
Brightness Level Adjustment		50		%FS
SWITCHING PERFORMANCE				
Maximum Conversion Rate	150			MSPS
Minimum Conversion Rate			12	MSPS
HSYNC Input Frequency	15		200	kHz
PLL Clock Rate	12		150	MHz
PLL Jitter		500		ps p-p
Sampling Phase Tempco		15		ps/°C
DYNAMIC PERFORMANCE				
Analog Bandwidth, Full Power		300		MHz
Channel to Channel Matching		0.5%		Full-Scale
DIGITAL INPUTS				
Input Voltage, High (V_{IH})	2.5			V
Input Voltage, Low (V_{IL})			0.8	V
Input Current, High (I_{IH})			-1.0	uA
Input Current, Low (I_{IL})			1.0	uA
Input Capacitance		5		pF
DIGITAL OUTPUTS				
Output Voltage, High (V_{OH})	VDDP-0.1			V
Output Voltage, Low (V_{OL})			0.1	V
VIDEO ANALOG OUTPUT				
CVBS Buffer Output				
Output Low		0.85		V
Output High		1.85		V

Parameter	Min	Typ	Max	Unit
AUDIO				
ADC Input		2.0		V p-p
DAC Output		2.0		V p-p
SIF Input Range				
Minimum			0.1	V p-p
Maximum	1.0			V p-p
FSSW Input ¹	0		1.8	V
SAR ADC Input	0		3.3	V
FB ADC Input ²	0		1.25	V

Specifications subject to change without notice.

Notes:

1. Input full scale is typically 1.8V, but input range is 0 ~ 3.3V.
2. Input full scale is 1.25V, but input range is 0 ~ 3.3V.

Absolute Maximum Ratings

Parameter	Symbol	Min	Typ	Max	Units
3.3V Supply Voltages	V_{VDD_33}	-0.3		3.6	V
2.5V Supply Voltages	V_{VDD_25}	-0.3		2.75	V
1.8V Supply Voltages	V_{VDD_18}	-0.3		1.98	V
Input Voltage (5V tolerant inputs)	$V_{IN5Vtol}$	-0.3		5.0	V
Input Voltage (non 5V tolerant inputs)	V_{IN}	-0.3		V_{VDD_33}	V
Ambient Operating Temperature	T_A	0		70	°C
Storage Temperature	T_{STG}	-40		150	°C
Junction Temperature	T_J			150	°C
Thermal Resistance (Junction to Air) Natural Conversion	θ_{JA}		TBD		°C/W
Thermal Resistance (Junction to Case) Natural Conversion	θ_{JC}		TBD		°C/W

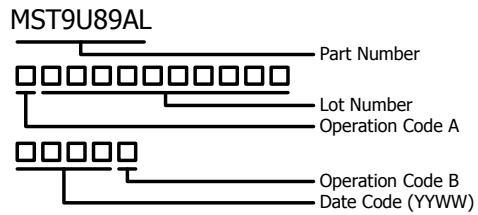
Note: Stress above those listed under Absolute Maximum Rating may cause permanent damage to the device. This is a stress rating only; functional operation of the device at these or any other conditions outside of those indicated in the operation sections of this specification is not implied. Exposure to absolute maximum ratings for extended periods may affect device reliability.

ORDERING GUIDE

Model	Temperature Range	Package Description	Package Option
MST9U89AL	0°C to +70°C	LQFP	256
MST9U89AL-LF	0°C to +70°C	LQFP	256

Note: Product suffix "LF" represents lead-free version.

MARKING INFORMATION



DISCLAIMER

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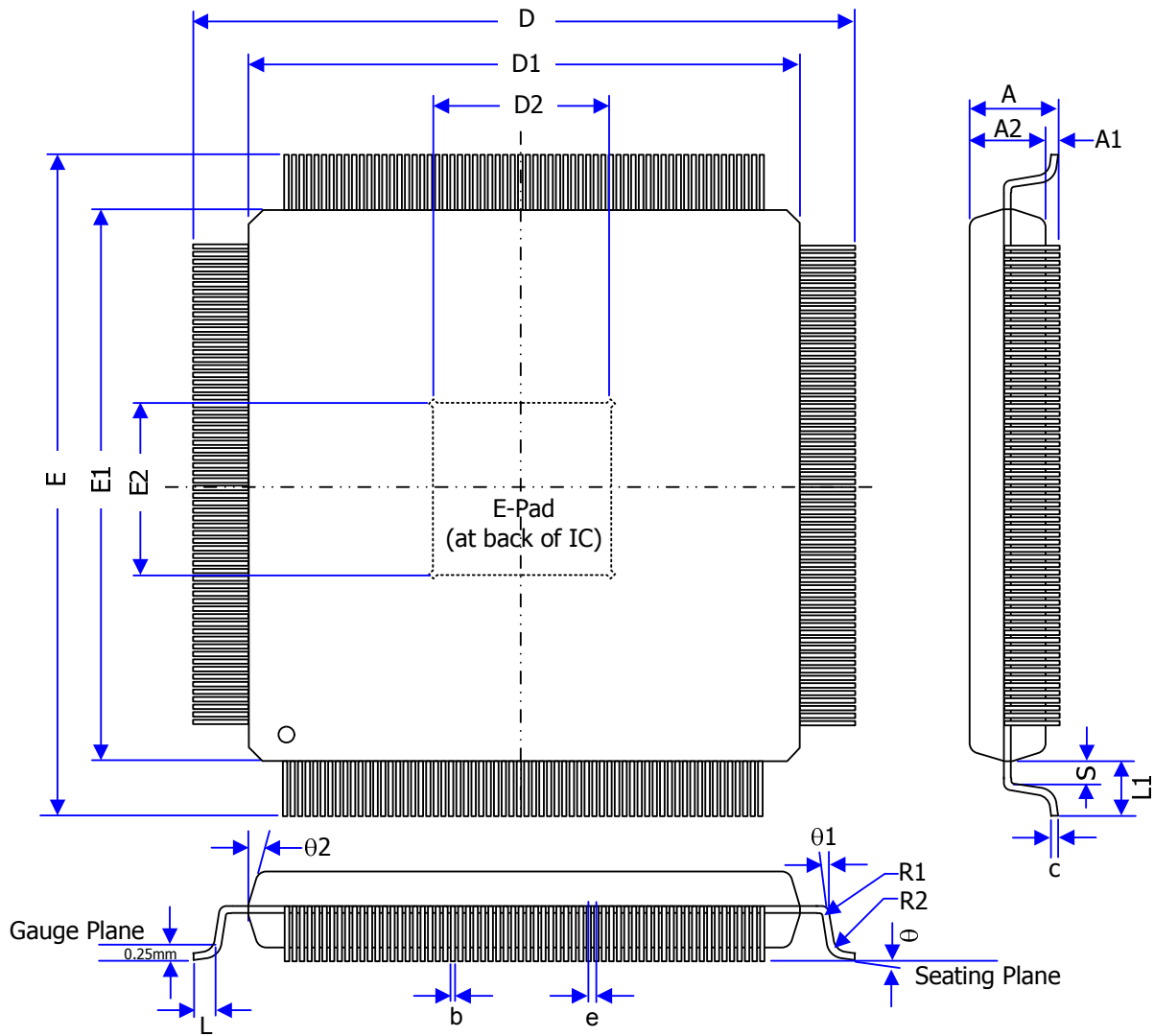


Electrostatic charges accumulate on both test equipment and human body and can discharge without detection. MST9U89AL comes with ESD protection circuitry; however, the device may be permanently damaged when subjected to high energy discharges. The device should be handled with proper ESD precautions to prevent malfunction and performance degradation.

REVISION HISTORY

Document	Description	Date
MST9U89AL_ds_v01	• Initial release	Jul 2006
MST9U89AL_ds_v02	• Updated Features \ PIP/PBP/POP feature description	Jul 2006
MST9U89AL_ds_v03	• Updated HDMI as a standard feature in related information	Jul 2006
MST9U89AL_ds_v04	• Updated Register Table	Jul 2006
MST9U89AL_ds_v05	• Added GPIOF[10:2] and all related information	Aug 2006

MECHANICAL DIMENSIONS



Symbol	Millimeter			Inch		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	-	-	1.6	-	-	0.063
A1	0.05	-	-	0.002	-	-
A2	1.35	1.40	1.45	0.053	0.055	0.057
D	30.00			1.181		
D1	28.00			1.102		
D2	8.50	-	9.05	0.346	-	0.356
E	30.00			1.181		
E1	28.00			1.102		
E2	8.50	-	9.05	0.346	-	0.356

Symbol	Millimeter			Inch		
	Min.	Nom.	Max.	Min.	Nom.	Max.
theta	0°	-	7°	0°	-	7°
theta 1	0°	-	-	0°	-	-
theta 2	12° Ref			12° Ref		
b	0.11	0.16	0.21	0.004	0.006	0.008
c	0.12	-	0.20	0.005	-	0.008
e	0.40 TYP.			0.0157 TYP.		
L	0.45	0.60	0.75	0.018	0.024	0.030
L1	1.00 Ref			0.039 Ref		
S	0.20	-	-	0.008	-	-

SPECIFICATION FOR APPROVAL

- () Preliminary Specification
- () Final Specification

Title	42.0" WUXGA TFT LCD
-------	---------------------

BUYER	General
MODEL	

SUPPLIER	LG.Philips LCD Co., Ltd.
*MODEL	LC420WU1
SUFFIX	SL01

*When you obtain standard approval, please use the above model name without suffix

APPROVED BY	SIGNATURE DATE
/	
/	
/	

APPROVED BY	SIGNATURE DATE
C. H. Och / G. Manager	
REVIEWED BY	
H. M. Moon / Manager	
PREPARED BY	
Y.H.Choi / Engineer	

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

**TV Product Development Dept.
LG. Philips LCD Co., Ltd**

Product Specification

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Product Specification

RECORD OF REVISIONS

Revision No.	Revision Date	Page	Description
0.0	Feb.03, 2005	-	Preliminary Specification(First Draft)
0.1	Apr.21, 2005	-	Preliminary Specification(Second Draft)
0.2	May.17, 2005	5	Table 1. Absolute maximum ratings
		12	Table 7.Timing table
		16	Table 10. Power sequence for Inverter
		17,18	Optical Specification
1.0	July.22,2005	-	Correction for The Number of Table
		2	Add Contents for Page29
		7	Table 3. Electrical Characteristics
		7	Add note 4 for unloading input voltage
		12	Table 8. Time Table for NTSC & Table 9 Time Table for PAL
		13	3-4. Signal Time Waveforms
		17	Table 13. Optical Characteristics
		18	Add note 7 for Black Level and Black Uniformity
		18	Table 14. Gray Scale Specification (Luminance [%] (Typ.) with DCR)
		22,23	Change The Mechanical Drawing for Front and Rear View
		24	Table.16 Environment Test Condition
		25	Apply New IEC Standard for 7-1.Safety and 7-2. EMC
		29	Add Appendix A for Inverter Input Voltage Protection Circuit
		30	Add Appendix B for Black Level and Black Uniformity

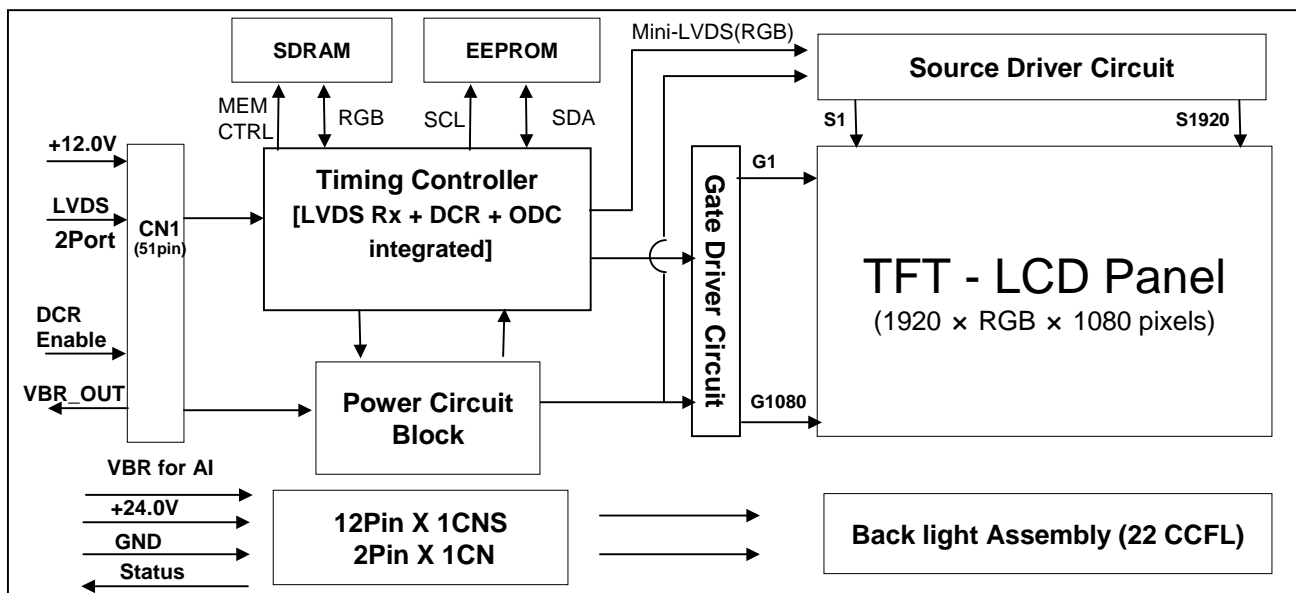
Product Specification

1. General Description

The LC420WU1 is a Color Active Matrix Liquid Crystal Display with an integral Cold Cathode Fluorescent Lamp(CCFL) backlight system. The matrix employs a-Si Thin Film Transistor as the active element. It is a transmissive display type which is operating in the normally black mode. It has a 42.02 inch diagonally measured active display area with WUXGA resolution (1080 vertical by 1920 horizontal pixel array). Each pixel is divided into Red, Green and Blue sub-pixels or dots which are arrayed in vertical stripes. Gray scale or the luminance of the sub-pixel color is determined with a 8-bit gray scale signal for each dot. Therefore, it can present a palette of more than 16.7M(true) colors.

It has been designed to apply the 8-bit 2-port LVDS interface.

It is intended to support LCD TV, PCTV where high brightness, super wide viewing angle, high color gamut, high color depth and fast response time are important.



General Features

Active Screen Size	42.02 inches(1067.31mm) diagonal
Outline Dimension	1005.6(H) x 609.8 (V) x 55.5 mm(D) (Typ.)
Pixel Pitch	0.4845 mm x 0.4845 mm
Pixel Format	1920 horiz. by 1080 vert. Pixels, RGB stripe arrangement
Color Depth	8-bit, 16.7 M colors
Luminance, White	550 cd/m ² (Center 1point ,Typ.)
Viewing Angle (CR>10)	Viewing angle free (R/L 178 (Typ.), U/D 178 (Typ.))
Power Consumption	Total 187.3 W (Typ.) (Logic=7.3 W, Inverter=180 W [I _{BL} = 6.5mA])
Weight	14.5K g (Typ.)
Display Mode	Transmissive mode, Normally black
Surface Treatment	Hard coating(3H), Anti-glare treatment of the front polarizer

Product Specification

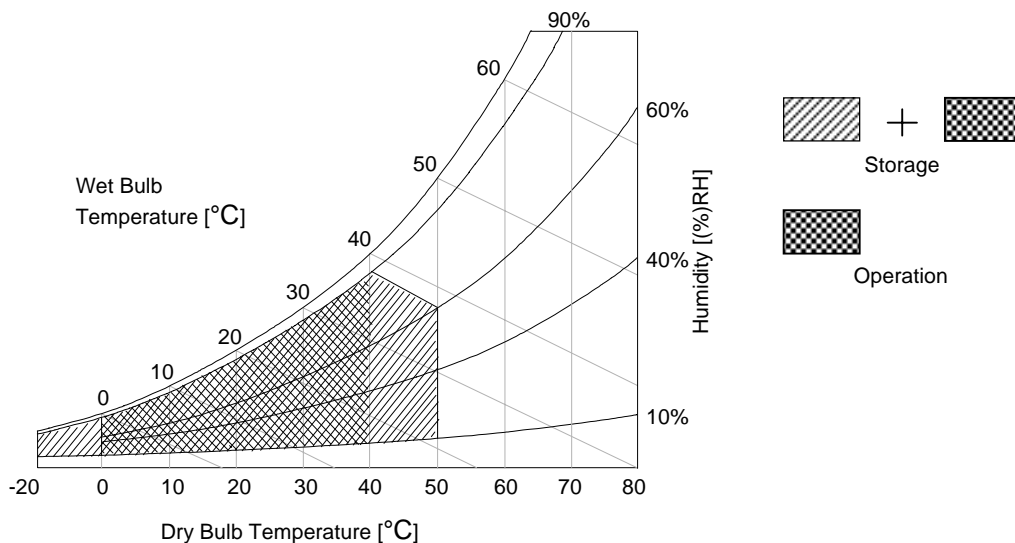
2. Absolute Maximum Ratings

The following items are maximum values which, if exceeded, may cause faulty operation or damage to the LCD module.

Table 1. ABSOLUTE MAXIMUM RATINGS

Parameter		Symbol	Value		Unit	Remark
			Min	Max		
Power Input Voltage	LCM	VLCD	-0.3	+14.0	Vdc	at 25 ± 2 °C
	Backlight inverter	VBL	+21.6	+26.0	Vdc	
ON/OFF Control Voltage		VON/OFF	-0.3	+5.25	Vdc	
Brightness Control Voltage		VBr	0	+3.3	Vdc	
Operating Temperature		TOP	0	+40	°C	Note 1
Storage Temperature		TST	-20	+50	°C	
Operating Ambient Humidity		HOP	10	90	%RH	
Storage Humidity		HST	10	90	%RH	

Note : 1. Temperature and relative humidity range are shown in the figure below.
Wet bulb temperature should be 39 °C Max. and no condensation of water.



3. Electrical Specifications

3-1. Electrical Characteristics

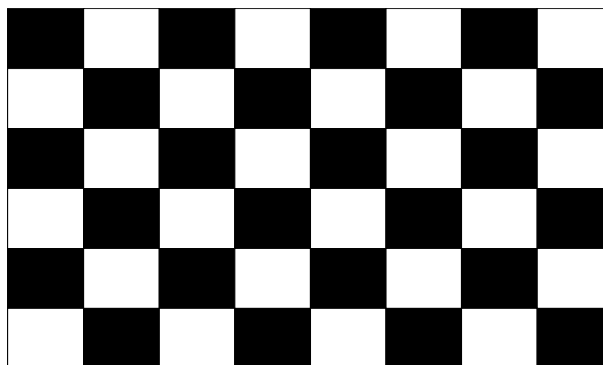
It requires two power inputs. One is employed to power for the LCD circuit. The other is used for the CCFL backlight and inverter circuit.

Table 2. ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Value			Unit	Note
		Min	Typ	Max		
Circuit :						
Power Input Voltage	V _{LCD}	11.4	12.0	12.6	V _{dc}	
Power Input Current	I _{LCD}	-	610	793	mA	1
		-	820	1066	mA	2
Power Consumption	P _{LCD}	-	7.3	9.5	Watt	1
Rush current	I _{RUSH}	-	-	3.0	A	3

- Note :
1. The specified current and power consumption are under the $V_{LCD}=12.0V$, $25 \pm 2^{\circ}C$, $f_V=60Hz$ condition whereas mosaic pattern(8 x 6) is displayed and f_V is the frame frequency.
 2. The current is specified at the maximum current pattern.
 3. The duration of rush current is about 2ms and rising time of power input is 1ms (min.).

White : 255Gray
Black : 0Gray



Mosaic Pattern(8 x 6)

Product Specification

Table 3. ELECTRICAL CHARACTERISTICS (Continue)

Parameter		Symbol	Value			Unit	Note
			Min	Typ	Max		
Inverter :							
Power Input Voltage		VBL	22.8	24.0	26.0	VDC	1
Power Supply Input Voltage Ripple			-0.2		0.2	Vp-p	
Unloading Input Voltage					28	Vdc	
Power Input Current		IBL	6	7.5	9	A	
Power Consumption		PBL	160	180	200	W	
Input Voltage for Control System Signals	Brightness Adjust	VBR	0		3.3	VDC	2
	On/Off	On	V on	2.5		5.0	VDC
		Off	V off	-0.3	0.0	0.5	VDC
Lamp :							
Life Time			50,000			Hrs	3

Note :

- Electrical characteristics are determined after the unit has been 'ON' and stable for approximately 120 minutes at $25 \pm 2^\circ\text{C}$
The specified current and power consumption are under the typical supply Input voltage, it is total power consumption.
The ripple voltage of the power supply input voltage is under 0.2 Vp-p.
LPL recommend Input Voltage is $24.0\text{V} \pm 5\%$.
- Brightness Control.
This VBR Voltage control brightness.

VBR Voltage	Function
3.3V	Maximum Brightness (100%)
0V	Minimum Brightness.(Burst On Duty 25%)

- The life is determined as the time at which luminance of the lamp is 50% compared to that of initial value at the typical lamp current on condition of continuous operating at $25 \pm 2^\circ\text{C}$.
Specified value is when lamp is aligned horizontally.
- The maximum value for unloading Input Voltage is only valid as inverter enable signal is off.
Please refer to page 16 for inverter on/off power sequence condition.

Product Specification

3-2. Interface Connections

This LCD module employs two kinds of interface connection, a 51-pin connector is used for the module electronics and two 12-pin connectors are used for the integral backlight system.

3-2-1. LCD Module

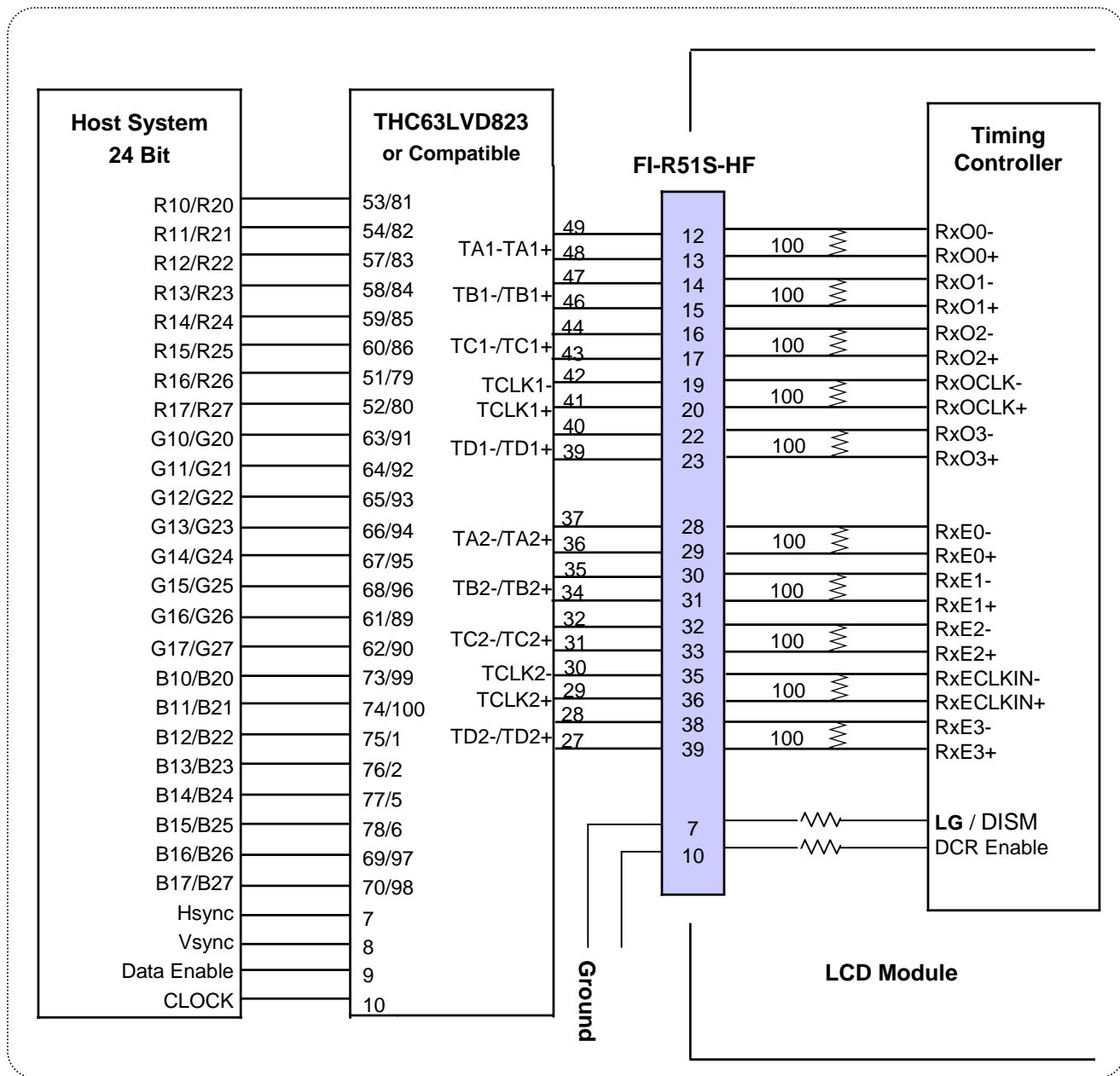
- LCD Connector(CN1): FI-R51S-HF(manufactured by JAE) or equivalent
- Mating Connector : FI-R51HL(JAE) or compatible

Table 4. MODULE CONNECTOR(CN1) PIN CONFIGURATION

No	Symbol	Description	No	Symbol	Description
1	Reserved (NC)	No connection	27	Reserved	No connection or GND
2	Reserved (NC)	No connection	28	RE0N	SECOND CHANNEL 0-
3	Reserved (NC)	No connection	29	RE0P	SECOND CHANNEL 0+
4	Reserved (NC)	No connection	30	RE1N	SECOND CHANNEL 1-
5	Reserved (NC)	No connection	31	RE1P	SECOND CHANNEL 1+
6	Reserved (NC)	No connection	32	RE2N	SECOND CHANNEL 2-
7	Reserved (NC)	No connection	33	RE2P	SECOND CHANNEL 2+
8	Reserved (NC)	No connection	34	GND	Ground
9	Reserved (NC)	No connection	35	RECLKN	SECOND CLOCK CHANNEL C-
10	Reserved (NC)	No connection	36	RECLKP	SECOND CLOCK CHANNEL C+
11	GND	Ground	37	GND	Ground
12	RO0N	FIRST CHANNEL 0-	38	RE3N	SECOND CHANNEL 3-
13	RO0P	FIRST CHANNEL 0+	39	RE3P	SECOND CHANNEL 3+
14	RO1N	FIRST CHANNEL 1-	40	Reserved (NC)	No connection
15	RO1P	FIRST CHANNEL 1+	41	Reserved (NC)	No connection
16	RO2N	FIRST CHANNEL 2-	42	Reserved	No connection or GND
17	RO2P	FIRST CHANNEL 2+	43	Reserved	No connection or GND
18	GND	Ground	44	GND	Ground
19	ROCLKN	FIRST CLOCK CHANNEL C-	45	GND	Ground
20	ROCLKP	FIRST CLOCK CHANNEL C+	46	GND	Ground
21	GND	Ground	47	NC	No connection
22	RO3N	FIRST CHANNEL 3-	48	VLCD	Power Supply +12.0V
23	RO3P	FIRST CHANNEL 3+	49	VLCD	Power Supply +12.0V
24	Reserved (NC)	No connection	50	VLCD	Power Supply +12.0V
25	Reserved (NC)	No connection	51	VLCD	Power Supply +12.0V
26	Reserved	No connection or GND	-	-	-

- Note :
1. All GND(ground) pins should be connected together to the LCD module's metal frame.
 2. All VLCD (power input) pins should be connected together.
 3. All Input levels of LVDS signals are based on the IEA 664 Standard.

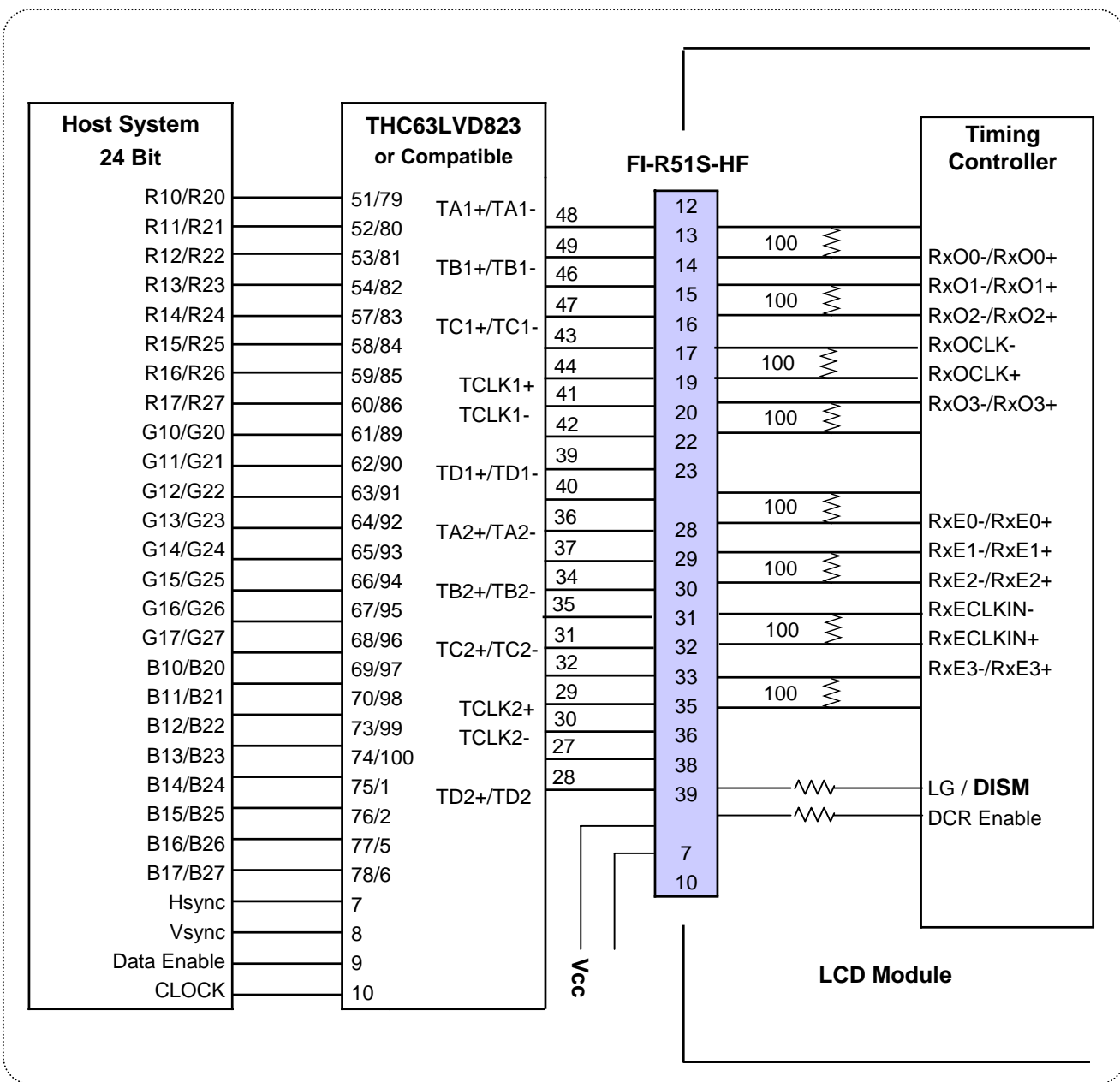
Table 5. Required signal assignment for Flat Link (Thine : THC63LVD823) Transmitter(Pin7="L")



Note:

1. The LCD module uses a 100 Ohm() resistor between positive and negative lines of each receiver input.
2. Refer to LVDS transmitter data sheet for detail descriptions. (THC63LVD823 or Compatible)
3. '7' means MSB and '0' means LSB at R,G,B pixel data.

Table 6. Required signal assignment for Flat Link (Thine : THC63LVD823) Transmitter(Pin7="H")



Note:

1. The LCD module uses a 100 Ohm() resistor between positive and negative lines of each receiver input.
2. Refer to LVDS transmitter data sheet for detail descriptions. (THC63LVD823 or Compatible)
3. '7' means MSB and '0' means LSB at R,G,B pixel data.

Product Specification

3-2-2. Backlight Inverter

Input Connector

-Inverter Connector : S12B-PH-SM3(manufactured by JST) or Equivalent

-Mating Connector : PHR-12 or Equivalent

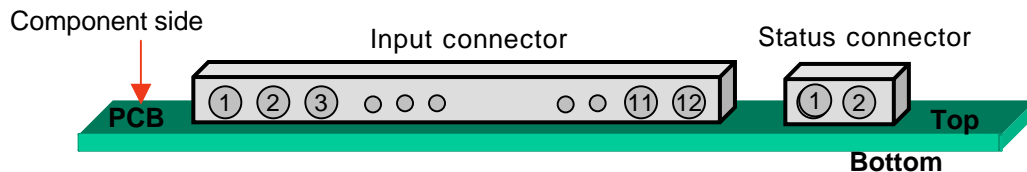
Status Connector

-Inverter Connector : 20022WR-02A00(manufactured by Yeon Ho co., Korea)

-Mating Connector : 20022HR-02S00(manufactured by Yeon Ho co., Korea)

Table 7. INVERTER CONNECTOR PIN CONFIGURATION

Pin No	Symbol	Description	Master	Slave	Note
1	VBL	Power Supply +24.0V	VBL	VBL	
2	VBL	Power Supply +24.0V	VBL	VBL	
3	VBL	Power Supply +24.0V	VBL	VBL	
4	VBL	Power Supply +24.0V	VBL	VBL	
5	VBL	Power Supply +24.0V	VBL	VBL	
6	GND	POWER GND	GND	GND	
7	GND	POWER GND	GND	GND	
8	GND	POWER GND	GND	GND	1
9	GND	POWER GND	GND	GND	
10	GND	POWER GND	GND	GND	
11	VBR	0V ~ 3.3V	VBR	Don't care	2
12	On/Off	0V ~ 5.0V	On/Off	Don't care	3
Option Pin(Lamp Open Status Detection)					
1	GND	POWER GND	GND		
2	Status	Upper 3.0V(Normal), Under 0.7V(Abnormal)	Status		



Note : 1. GND should be connected to the LCD module's metal frame.

2. Minimum Brightness : VBR = 0.0V
Maximum Brightness : VBR = 3.3V

3. VON : 2.5 ~ 5.0V
VOFF : -0.3 ~ 0.5V

Product Specification

3-3. Signal Timing Specifications

Table 8 and Table9 show the signal timing required at the input of the LVDS transmitter. All of the interface signal timing should be satisfied with the following specification for normal operation.

Table 8. TIMING TABLE for NTSC

ITEM		SYMBOL	Min.	Typ.	Max.	Unit	Notes
DCLK Period		t_{CLK}	12.98	13.47	13.98	nsec	
DCLK Frequency		f_{CLK}	71.55	74.25	77	MHz	=148.5 /2
Vertical	Frequency	f_V	57	60	63	Hz	
	Valid	t_{VV}	-	1080	-	Line	
	Blank	$t_{VT} - t_{VV}$	11	45	69	Line	
	Total	t_{VT}	1091	1125	1149	Line	
Horizontal	Frequency	f_H	65.46	67.5	68.94	KHz	
	Valid	t_{HV}	-	960	-	t_{CLK}	
	Blank	$t_{HT} - t_{HV}$	100	140	320	t_{CLK}	
	Total	t_{HT}	1060	1100	1280	t_{CLK}	=2200/2

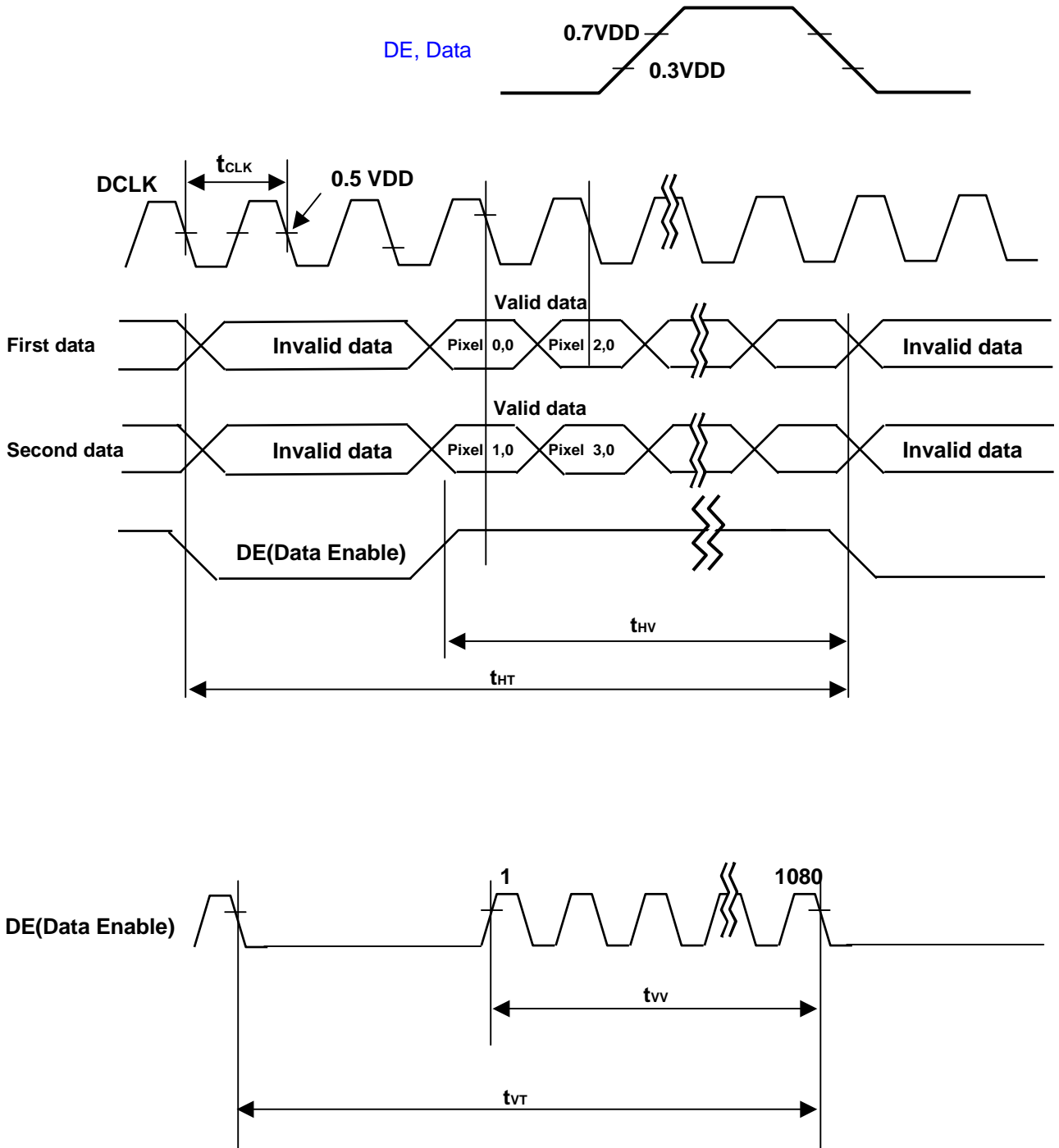
Table 9. TIMING TABLE for PAL

ITEM		SYMBOL	Min.	Typ.	Max.	Unit	Notes
DCLK Period		t_{CLK}	14.81	16.16	16.77	nsec	
DCLK Frequency		f_{CLK}	59.63	61.88	67.5	MHz	=123.75 /2
Vertical	Frequency	f_V	47	50	53	Hz	
	Valid	t_{VV}	-	1080	-	Line	
	Blank	$t_{VT} - t_{VV}$	25	45	65	Line	
	Total	t_{VT}	1105	1125	1145	Line	
Horizontal	Frequency	f_H	55.25	56.25	57.25	KHz	
	Valid	t_{HV}	-	960	-	t_{CLK}	
	Blank	$t_{HT} - t_{HV}$	100	140	240	t_{CLK}	
	Total	t_{HT}	1060	1100	1200	t_{CLK}	=2200/2

Note :

1. The performance of the electro-optical characteristics may be influenced by variance of the vertical refresh rate.
2. Above Timing Tables are only valid for DE Mode.

3-4. Signal Timing Waveforms



Product Specification

3-5. Color Data Reference

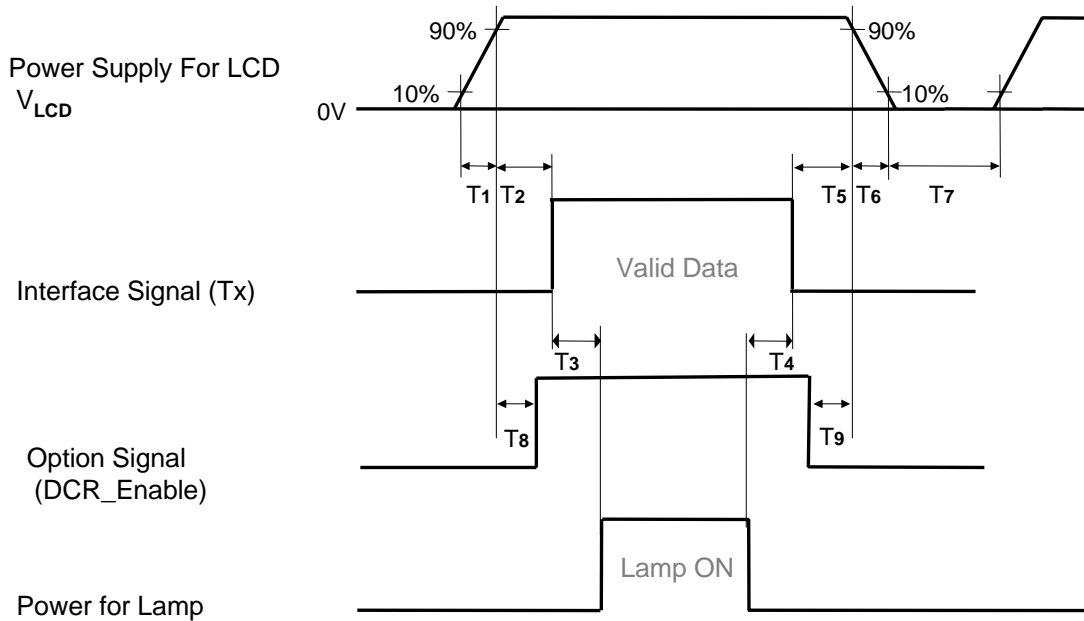
The brightness of each primary color(red,green,blue) is based on the 8-bit gray scale data input for the color. The higher binary input, the brighter the color. Table 10 provides a reference for color versus data input.

Table 10. COLOR DATA REFERENCE

Color		Input Color Data																							
		RED								GREEN								BLUE							
		MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB								
R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0		
Basic Color	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red (255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green (255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Blue (255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	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	1	1	1	1	1	1
RED	RED (000) Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED (001)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
							
	RED (254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED (255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GREEN	GREEN (000) Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN (001)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
							
	GREEN (254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	GREEN (255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
BLUE	BLUE (000) Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	BLUE (001)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
							
	BLUE (254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	BLUE (255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

3-6. Power Sequence

3-6-1. LCD Driving circuit

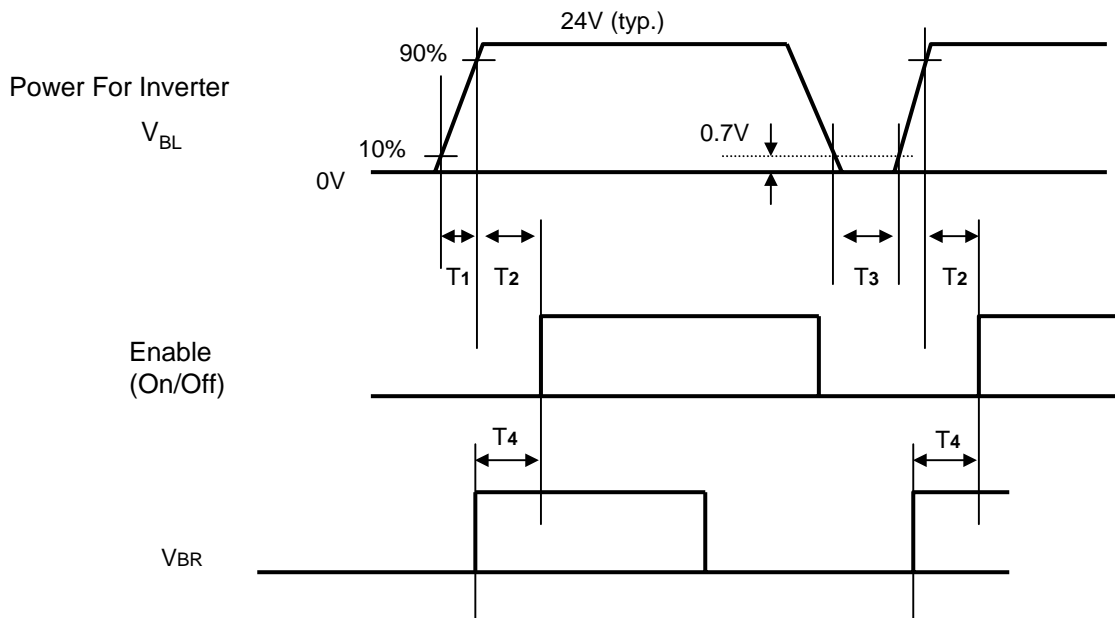

Table 11. POWER SEQUENCE

Parameter	Value			Unit
	Min	Typ	Max	
T1	0.5	-	20	ms
T2	0.5	-	50	ms
T3	200	-	-	ms
T4	200	-	-	ms
T5	0.5	-	50	ms
T6	-	-	100	ms
T7	2.0	-	-	s
T8	0 < T8 < T2			ms
T9	0 < T9 < T5			ms

- Note :
1. Please avoid floating state of interface signal at invalid period.
 2. When the interface signal is invalid, be sure to pull down the power supply V_{LCD} to 0V.
 3. The case when the T2/T5 exceed maximum specification, it operates protection pattern(Black pattern) till valid signal inputted. There is no reliability problem.
 4. The T3/T4 is recommended value, the case when failed to meet a minimum specification, abnormal display would be shown. There is no reliability problem.

Product Specification

3-6-2. On/Off for Inverter



3-6-3. Deep condition for Inverter

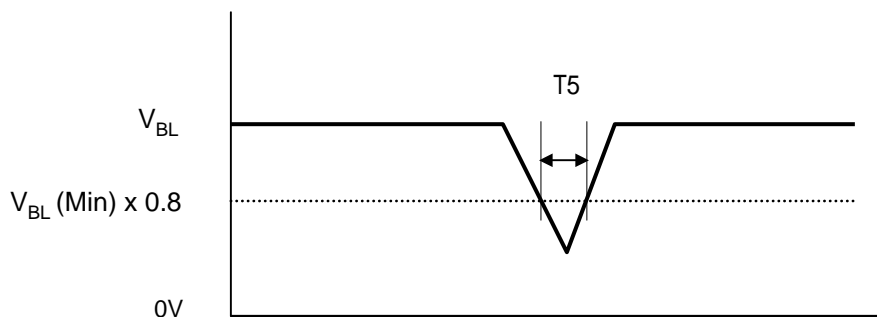


Table 12. POWER SEQUENCE FOR INVERTER

Parameter	Value			Unit	Remark
	Min	Typ	Max		
T1		-	20	ms	After Inverter's connected
T2	500	-	-	ms	
T3	200	-	-	ms	
T4	-100	-	-	ms	
T5	-	-	10	ms	$V_{BL}(\text{Min}) \times 0.8$

Product Specification

4. Optical Specification

Optical characteristics are determined after the unit has been 'ON' and stable for approximately 2 Hrs in a dark environment at $25 \pm 2^\circ\text{C}$. The specified optical values are measured at an approximate 50cm distance from the LCD surface on condition that viewing angle of Φ and θ equal to 0° .

FIG. 1 shows additional information concerning the measurement equipment and method.

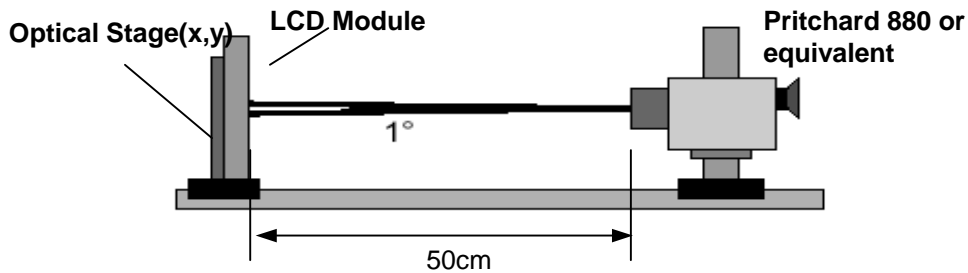


FIG. 1 Optical Characteristic Measurement Equipment and Method

Table 13. OPTICAL CHARACTERISTICS

$T_a = 25 \pm 2^\circ\text{C}$, $V_{LCD} = 12.0\text{V}$, $f_v = 60\text{Hz}$, $D_{clk} = 148.5\text{MHz}$, $VBR = 3.3\text{V}$

Parameter	Symbol	Value			Unit	Note	
		Min	Typ	Max			
Contrast Ratio	CR	600	800	-		1	
	CR with DCR	1100	1600	-			
Surface Luminance, white	L_{WH}	400	550	-	cd/m^2	2	
Luminance Variation	δ_{WHITE} 5P	-	-	1.6		3	
Response Time (Gray-to-Gray)	Gray-to-Gray	G to G	-	8	16	ms	4
	Rise + decay	$Tr_R + Tr_D$	-	18	-		
Color Coordinates [CIE1931]	RED	Rx	Typ -0.03	0.638	Typ +0.03		
		Ry		0.342			
	GREEN	Gx		0.286			
		Gy		0.613			
	BLUE	Bx		0.147			
		By		0.070			
	WHITE	Wx		0.285			
	Wy	0.293					
Viewing Angle (CR>10)							
	x axis, right($\phi=0^\circ$)	θ_r	85	89	-	degree	5
	x axis, left ($\phi=180^\circ$)	θ_l	85	89	-		
	y axis, up ($\phi=90^\circ$)	θ_u	85	89	-		
	y axis, down ($\phi=270^\circ$)	θ_d	85	89	-		
Gray Scale	Without DCR						6
	With DCR						
Black Level	L_{BLACK}	-	TBD	TBD			7
Black Uniformity	δ_{BLACK} 5P	-	TBD	TBD			

Product Specification

Note :

1. Contrast Ratio(CR) is defined mathematically as :

$$\text{Contrast Ratio} = \frac{\text{Surface Luminance with all white pixels}}{\text{Surface Luminance with all black pixels}}$$

Measure Position : Center 1-point

2. Surface Luminance(L_{WH}) is the luminance value measured at an approximate 50cm distance from the center 1-point of LCD surface as all pixels displaying white. See FIG. 2 for more information.
3. The variation of surface luminance , δ WHITE is defined as :
 δ WHITE(5P) = Maximum($L_{on1}, L_{on2}, L_{on3}, L_{on4}, L_{on5}$) / Minimum($L_{on1}, L_{on2}, L_{on3}, L_{on4}, L_{on5}$)
 Where L_{on1} to L_{on5} are the luminance with all pixels displaying white at 5 locations .
 For more information, see the FIG. 2.
4. Response time is defined as the required time for the transition from G(N) to G(M) (Rise Time, Tr_R) and from G(M) to G(N) (Decay Time, Tr_D). For additional information see the FIG. 3. ($N < M$)
5. Viewing angle is the angle at which the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD module surface. For more information, see the FIG. 4.
6. See Table 14 for gray scale specification
7. Black Level and Black Uniformity :
 This is only for the reference. Please refer to attached Appendix B for the details.

Table 14. GRAY SCALE SPECIFICATION

Gray Level	Luminance [%] (Typ.)	Luminance [%] (Typ.) with DCR
L0	0.19	0.06
L15	0.39	0.24
L31	1.16	0.82
L47	2.61	1.90
L63	4.80	3.64
L79	7.77	6.37
L95	11.56	9.77
L111	16.21	13.9
L127	21.73	18.5
L143	28.15	24.0
L159	35.50	31.1
L175	43.79	38.1
L191	53.04	46.7
L207	63.28	56.9
L223	74.50	69.5
L239	86.74	83.8
L255	100	100

Product Specification

Measuring point for surface luminance & measuring point for luminance variation.

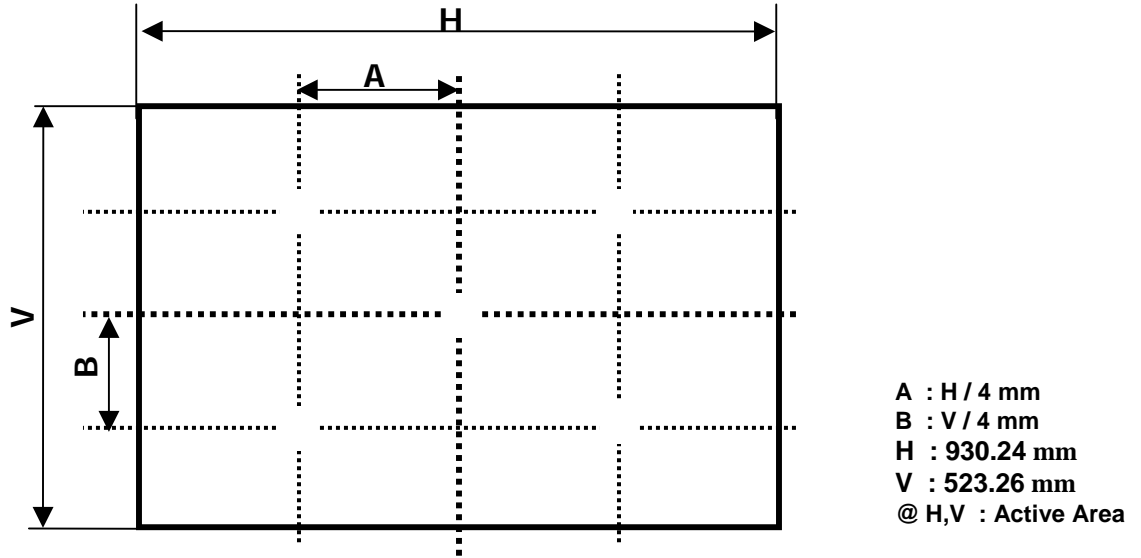


FIG. 2 5 Points for Luminance Measure

Response time is defined as the following figure and shall be measured by switching the input signal for "Gray(N)" and "Gray(M)".

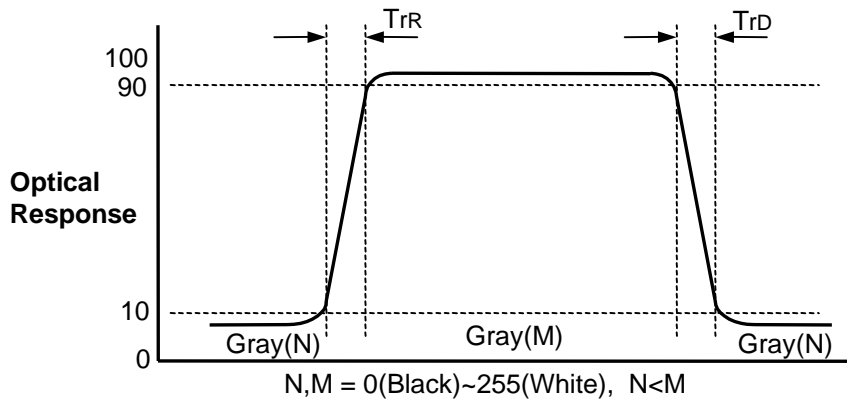


FIG. 3 Response Time

Product Specification

Dimension of viewing angle range

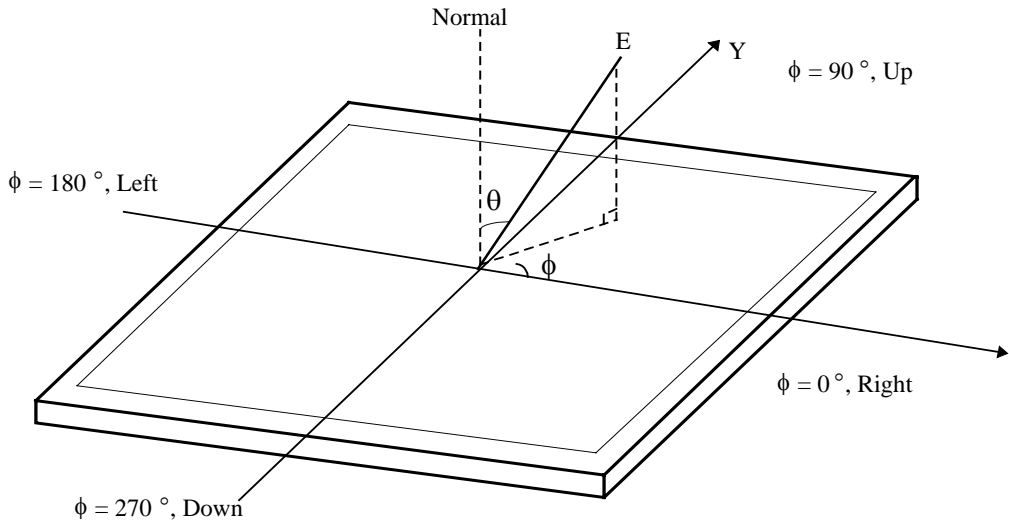


FIG. 4 Viewing Angle

Product Specification

5. Mechanical Characteristics

Table 13 provides general mechanical characteristics.

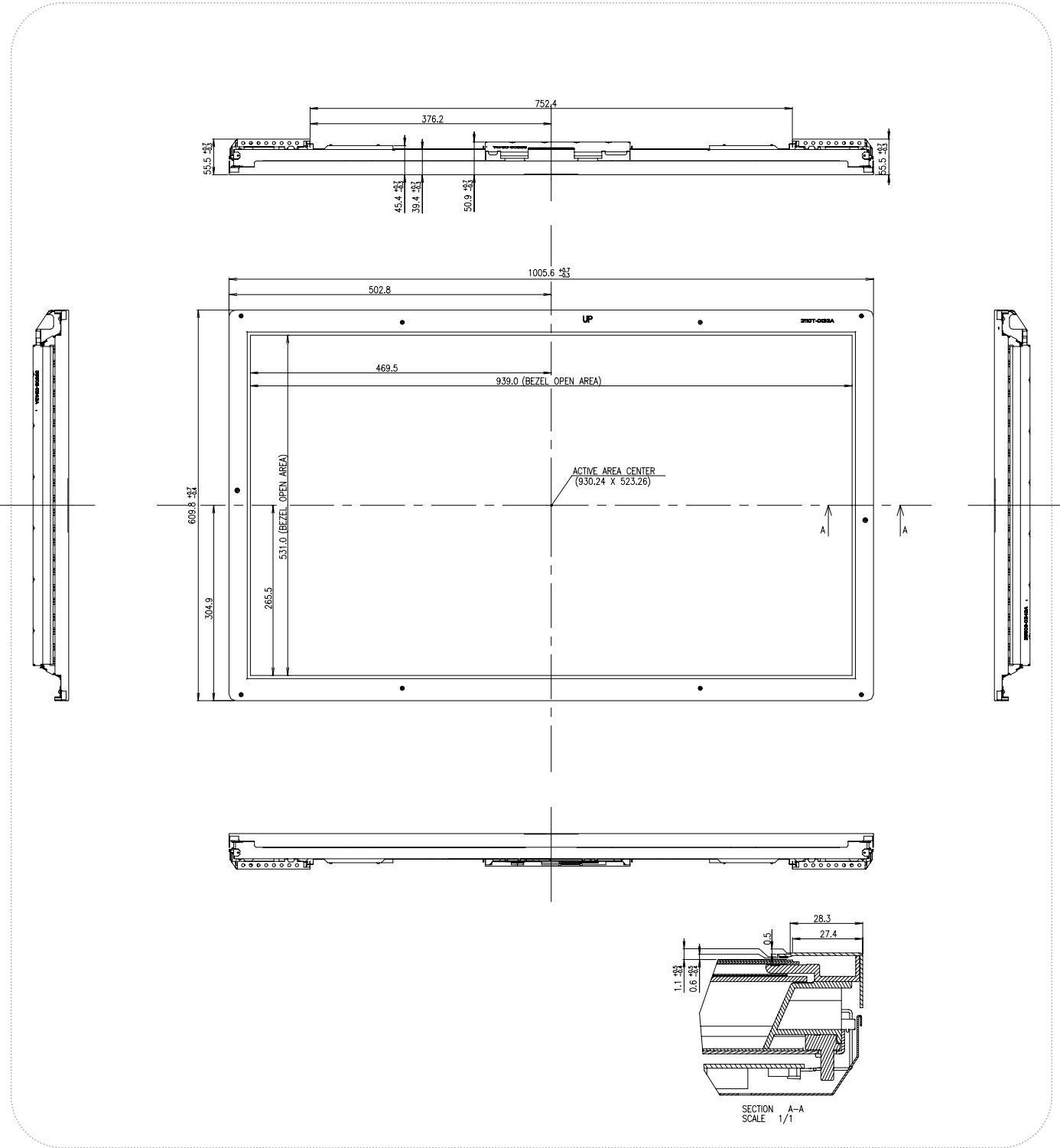
Table 15. MECHANICAL CHARACTERISTICS

Item	Value	
Outline Dimension	Horizontal	1005.6 mm
	Vertical	609.8 mm
	Depth	55.5 mm
Bezel Area	Horizontal	939.0 mm
	Vertical	531.0 mm
Active Display Area	Horizontal	930.24 mm
	Vertical	523.26 mm
Weight	14.5Kg (Typ.), 15.5Kg (Max.)	
Surface Treatment	Hard coating(3H) Anti-glare treatment of the front polarizer	

Note : Please refer to page21 and 22 for mechanic drawings in terms of tolerance.

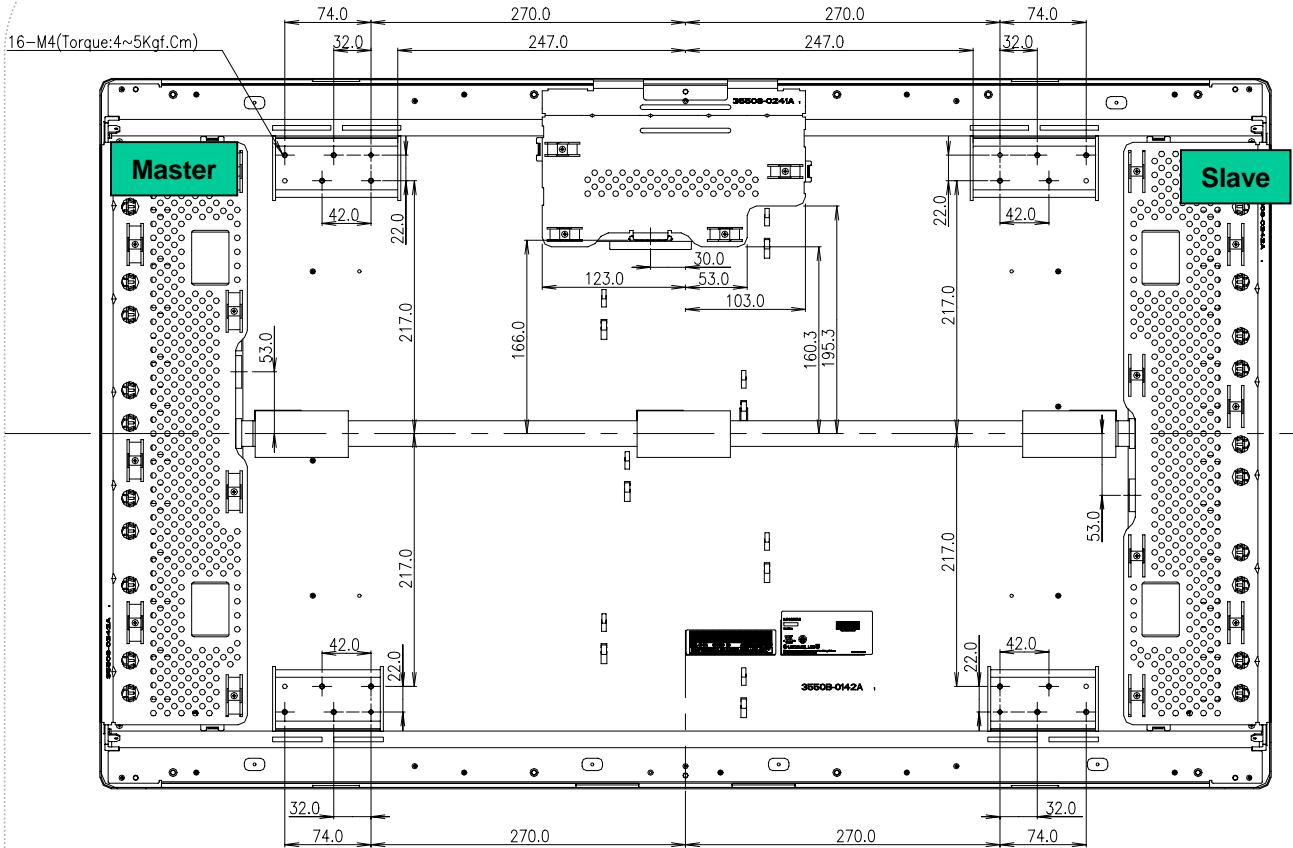
Product Specification

<FRONT VIEW>



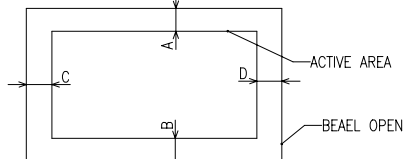
Product Specification

<REAR VIEW>



NOTES

1. Unspecified tolerances to be ± 0.5 .
2. This drawing is only preliminary data and can be changed without previous notice.
3. Tilt and partial disposition tolerance of display area as follow.
 - 1) Y-Direction : $|A-B| \leq 1.5$
 - 2) X-Direction : $|C-D| \leq 1.5$



4. The same shape is same dimension.

Product Specification

6. Reliability

Table 16. ENVIRONMENT TEST CONDITION

No.	Test Item	Condition
1	High temperature storage test	Ta= 50°C 240h
2	Low temperature storage test	Ta= -20°C 240h
3	High temperature operation test	Ta= 40°C 50%RH 240h
4	Low temperature operation test	Ta= 0°C 240h
5	Vibration test (non-operating)	Waveform : Random Vibration Level : 1.0G RMS Bandwidth : 10-500Hz Duration : X,Y,Z, 10 min / One time each direction
6	Shock test (non-operating)	Shock level : 100G Waveform : half sine wave, 2ms Direction : ± X, ± Y, ± Z One time each direction
7	Humidity condition Operation	Ta= 40 °C, 90%RH
8	Altitude operating storage / shipment	0 - 14,000 feet(4267.2m) 0 - 40,000 feet(12192m)

7. International Standards

7-1. Safety

- a) UL 60950-1:2003, First Edition, Underwriters Laboratories, Inc., Standard for Safety of Information Technology Equipment.
- b) CAN/CSA C22.2, No. 60950-1-03 1st Ed. April 1, 2003, Canadian Standards Association, Standard for Safety of Information Technology Equipment.
- c) EN 60950-1:2001, First Edition, European Committee for Electrotechnical Standardization(CENELEC) European Standard for Safety of Information Technology 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 (Including A1: 2000)

Product Specification

8. Packing

8-1. Designation of Lot Mark

a) Lot Mark

A	B	C	D	E	F	G	H	I	J	K	L	M
---	---	---	---	---	---	---	---	---	---	---	---	---

A,B,C : SIZE(INCH)

D : YEAR

F : PANEL CODE

H : ASSEMBLY CODE

E : MONTH

G : FACTORY CODE

I,J,K,L,M : SERIAL NO.

Note

1. YEAR

Year	97	98	99	2000	2001	2002	2003	2004	2005	2006	2007
Mark	7	8	9	0	1	2	3	4	5	6	7

2. MONTH

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mark	1	2	4	4	5	6	7	8	9	A	B	C

3. PANEL CODE

Panel Code	P1 Factory	P2 Factory	P3 Factory	P4 Factory	P5 Factory	Hydis Panel
Mark	1	2	3	4	5	H

4. FACTORY CODE

Factory Code	LPL Gumi	LPL Nanjing	Hee Sung
Mark	K	C	D

5. SERIAL NO.

Year	1 ~ 99999	100000 ~
Mark	00001 ~ 99999	A0001 ~ A9999, , Z9999

b) Location of Lot Mark

Serial NO. is printed on the label. The label is attached to the backside of the LCD module.
This is subject to change without prior notice.

8-2. Packing Form

a) Package quantity in one Pallet : 10 pcs

b) Pallet Size : 1140 mm X 1000 mm X 810 mm.

9. Precautions

Please pay attention to the followings when you use this TFT LCD module.

9-1. 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 the 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 causes circuit break by electro-chemical reaction.
- (6) Do not touch, push or rub the exposed polarizers 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 polarizers. 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.

9-2. 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) Response time depends on the temperature.(In lower temperature, it becomes longer.)
- (3) 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.
- (4) 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.
- (5) When fixed patterns are displayed for a long time, remnant image is likely to occur.
- (6) 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 minimized the interference.
- (7) Please do not give any mechanical and/or acoustical impact to LCM. Otherwise, LCM can't be operated its full characteristics perfectly.
- (8) A screw which is fastened up the steels should be a machine screw.
(if not, it causes metallic foreign material and deal LCM a fatal blow)
- (9) Please do not set LCD on its edge.

9-3. 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.

9-4. Precautions for Strong Light Exposure

Strong light exposure causes degradation of polarizer and color filter.

9-5. 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 container in which they were shipped.

9-6. 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.
- (2) 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.
- (3) You can remove the glue easily. When the glue remains on the bezel surface or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with normal-hexane.

Appendix A : Inverter Input Voltage Protection Circuit

The CAS is only defined as spec-in parameters, so LPL and Philips agree to make an appendix for inverter input voltage circuit application in terms of LC420WU1-SL01

1. Input Voltage Protection Circuit definition

Input Voltage Protection Circuit perceive abnormal input voltage coming at the Master & Slave inverter.

In case the inverter input voltage level is under 19.V or over 27.5V, this circuit operates for preventing inverter's abnormal operation.

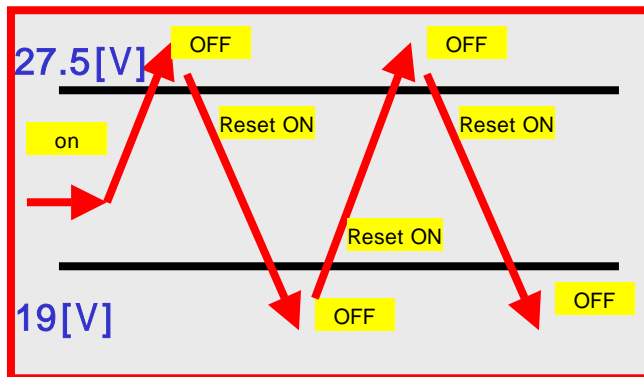
If inverter input voltage come back normal condition, this protection circuit will be reset and inverter works properly.

2. Input Voltage Protection Circuit Contents

The original purpose of inverter input voltage protection circuit is only for preventing inverter's damage. Please don't regard this circuit and voltage level as the parameters which should be controlled.

1) High Voltage Protection : Over 27.5V

2) Low Voltage Protection : Under 19V



3. Agreement

The protection circuit can't be eliminated without both of LPL and Philips agreement

Appendix B : Black Level and Black Uniformity

It is not available to be specified black level and black uniformity on the spec at this moment. So LPL will get more actual data for the future production(LC420WU1-SL01).

1. Black Level :

Surface Luminance of Black (L_{BLACK}) is the luminance value at center 1-point.

2. Black Uniformity

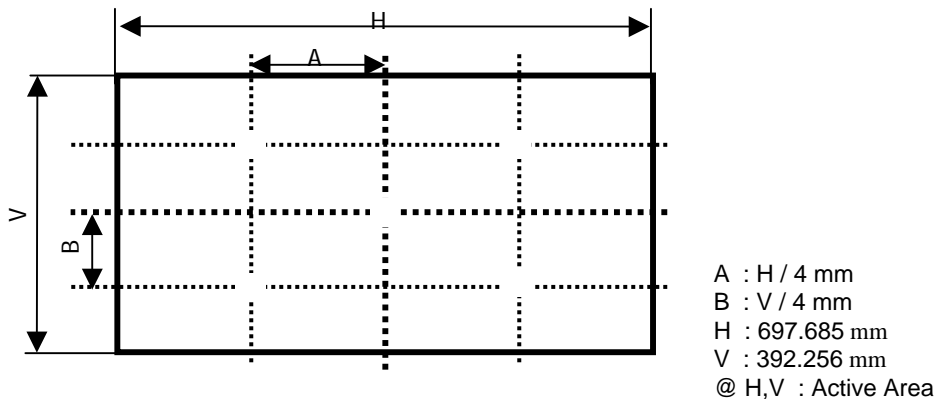
The variation of surface luminance of black , δ_{BLACK} is defined as :

$$\delta_{BLACK} = \text{Maximum}(L_{on1}, L_{on2}, L_{on3}, L_{on4}, L_{on5}) / \text{Minimum}(L_{on1}, L_{on2}, L_{on3}, L_{on4}, L_{on5})$$

3. Sampling Size : **regular RV event test quantity (5 pcs)**

4. Measurement Method : Follow same rule as optical characteristics measurement.

5. Measurement location: refer to below.



6. Current Status

Below is actual data of production on **RV (4 Jul 2005 ~ 5 Jul 2005)**. This is only useful for reference.

1) light leakage & Stitch limit sample : # 177

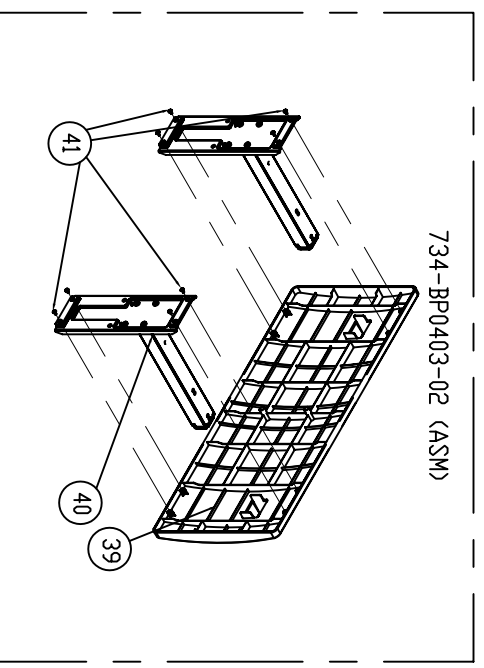
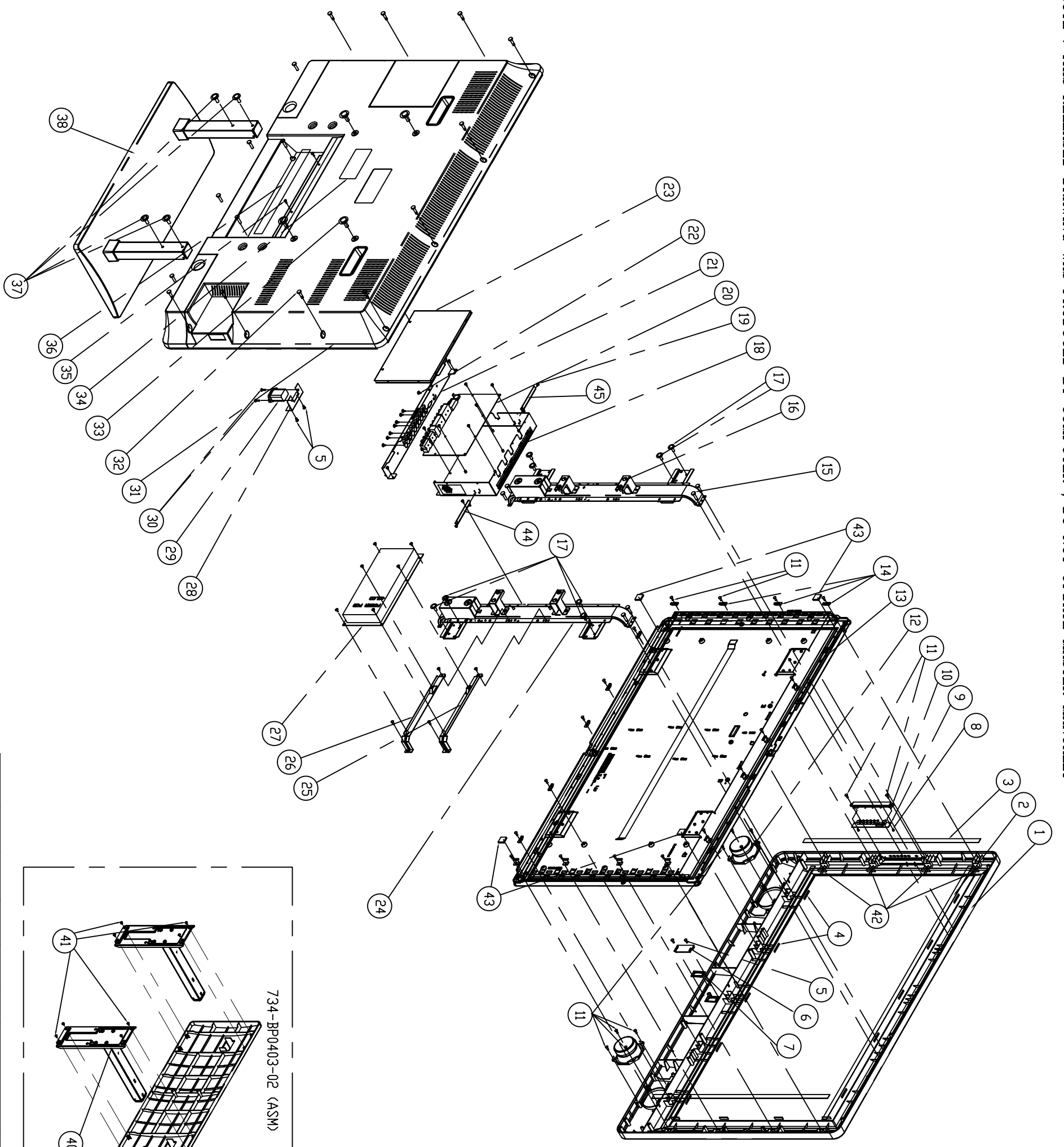
2) Touch limit sample : #148

No.	Luminance	Black Level
1	639	0.75
2	606	0.76
3	623	0.78
4	619	0.75
5	647	0.78

7. Plan to review Black Level and Black Uniformity

LPL will continue to monitor the black level and uniformity. Both LPL and Philips will review black level as well as black uniformity together. This spec will be discussed sooner or later. (end of Sept.)

NOTE : THIS RELEASED DRAWING WAS PRODUCED BY COMPUTER , DO NOT UPDATE MASTER MANUALLY



ITEM	PART NO.	DESCRIPTION	QTY	REMARK
45	6489-1-424E02-01SA	REAR END LEFT END BRACKET FOR MAIN	1	
44	6489-1-424E02-01SA	REAR END RIGHT END BRACKET FOR MAIN	1	
43	370-1-424E01-01	REAR END BRACKET FOR MAIN	4	
42	521-303009-01	REAR END BRACKET FOR MAIN	8	
41	612-303008-01	REAR END BRACKET FOR MAIN	8	
40	712-303008-01	REAR END BRACKET FOR MAIN	8	
39	231-303010-01	REAR END BRACKET FOR MAIN	2	ASN
38	734-BP0403-01	POWER SUPPLY ASSEMBLY FOR MAIN	1	ASN
37	600-303005-01	REAR END BRACKET FOR MAIN	4	
36	578-1-424E01-01AP	REAR END BRACKET FOR MAIN	4	
35	602-303008-01	REAR END BRACKET FOR MAIN	4	
34	560-1-424E01-03AP	REAR END BRACKET FOR MAIN	4	
33	602-601010-01	REAR END BRACKET FOR MAIN	4	
32	614-400412-01	REAR END BRACKET FOR MAIN	4	
31	202-1-424E01-01AA	REAR END BRACKET FOR MAIN	26	
30	601-303008-01	REAR END BRACKET FOR MAIN	2	
29	E342-1-252018	REAR END BRACKET FOR MAIN	1	
28	426-1-374002-01S	REAR END BRACKET FOR MAIN	1	
27	E780-1-020204	REAR END BRACKET FOR MAIN	1	
26	6429-1-424E02-01SA	REAR END BRACKET FOR MAIN	1	
25	6429-1-424E01-01SA	REAR END BRACKET FOR MAIN	1	ASN
24	713-1-424E01-01A	REAR END BRACKET FOR MAIN	1	
23	602-303004-10	REAR END BRACKET FOR MAIN	1	
22	602-303004-10	REAR END BRACKET FOR MAIN	1	
21	E780-1-020204	REAR END BRACKET FOR MAIN	1	
20	602-303006-10	REAR END BRACKET FOR MAIN	25	
19	6481-1-424E02-01SA	REAR END BRACKET FOR MAIN	1	
18	600-407008-10	REAR END BRACKET FOR MAIN	8	
17	713-1-424E03-01	REAR END BRACKET FOR MAIN	1	ASN
16	614-400412-01	REAR END BRACKET FOR MAIN	14	
15	6429-1-424E01-01SA	REAR END BRACKET FOR MAIN	14	
14	6429-1-424E01-01SA	REAR END BRACKET FOR MAIN	14	
13	E480-1-427001	REAR END BRACKET FOR MAIN	2	
12	614-380101-01	REAR END BRACKET FOR MAIN	26	
11	E470-1-020204	REAR END BRACKET FOR MAIN	2	
10	E470-1-020204	REAR END BRACKET FOR MAIN	2	
9	602-303008-01	REAR END BRACKET FOR MAIN	2	
8	602-303008-01	REAR END BRACKET FOR MAIN	2	
7	602-303008-01	REAR END BRACKET FOR MAIN	2	
6	614-303008-01	REAR END BRACKET FOR MAIN	1	
5	614-303008-01	REAR END BRACKET FOR MAIN	1	
4	614-303008-01	REAR END BRACKET FOR MAIN	10	
3	521-303005-01	REAR END BRACKET FOR MAIN	2	
2	521-303005-01	REAR END BRACKET FOR MAIN	2	
1	200-1-424E02-02AA	REAR END BRACKET FOR MAIN	1	

DRAWN,	TOLERANCE UNLESS OTHERWISE SPECIFIED	KAWA	TITLE	LCT424E
CHECKED	0 MM ~ 8 MM ± 0.1	ELECTRONIC R & D CENTRE	MODEL NO.	LCT424E
APPRD.	8 MM ~ 25 MM ± 0.15		PART NO.	DWG. NO.
3rd ANGLE PROJECTION	25 MM ~ 50 MM ± 0.2		A2	EXP-1-424E02-01
	50 MM ~ 250 MM ± 0.3		SCALE NIL	QTY
	250 MM ~ ABOVE ± 0.5			SHEET 1 OF 1
	ANGULAR ± 1			

Spare part list for LCT42Z6TM

Item	Part Number	Part Description	Usage / unit	Unit	Key/Spare
1>	LCT42AEMIA1PS-A01	AKAI 42" MONITOR LCT42AE (LCT42Z6TM)(B) S-MST9U89AL LPL(LC420WU1-SLB1 V1.0) HORIZONTAL AC120V/60HZ USA SILVER/BLACK			
	510-L42AE02-01BK	HORIZONTAL CARTON BOX AKAI LCT42Z6TM S-MT9U89AL W/ PHOTO CARD USA K	1.000000	Piece	K
2>	580-L42AE1A-02AP	IB E FOR AKAI LCT42Z6TM MONITOR NO PIP LPL MST9U89AL USA	1.000000	Piece	K
3>	E7501-058001	AKAI REMOTE CONTROL K001 FOR 42" MONITOR S.V. MST9U89AL USA 34KEYS	1.000000	SET	K
4>	E7801-P02004	PCB ASSY PSU BOARD MEGMEET MLT198L FOR 42"LCD AC110-240V OUTPUT 5V/12V/24V/5VSB 300W	1.000000	SET	K
5>	771EL42AE01-04	MAIN PCB ASS'Y S-MST9U89AL LPL(LC420WU1) USA MONITOR	1.000000	SET	K
6>	200-L42AE02-01AA	CABINET FRONT MATT BLACK/SILVER LCT42Z6TM LPL USA A	1.000000	Piece	S
7>	202-L42AE01-01AA	CABINET BACK BLACK W/O DVD/ POWER SWITCH LCT42Z6TM A	1.000000	Piece	S
8>	269-42SD01-01L	REMOTE RECEIVE LENS	1.000000	Piece	S
9>	310-041204-01V	POLYBAG 4"X12"X0.04 AV	1.000000	Piece	S
10>	310-111404-07V	POLYBAG 11"X14"X0.04 FV	1.000000	Piece	S
11>	310-504004-01	POLYBAG EPF 50"X40"X0.04	1.000000	Piece	S
12>	370-42D102-01	PAD CORD SPONG FOR SPK	1.000000	Piece	S
13>	370-L42AE01-01	SUPPORT CUSHION 18X18X4MM	4.000000	Piece	S
14>	389-L42AE01-01	PVC SHEET 30X5X1.0MM WITH ADHESIVE BLACK	10.000000	Piece	S
15>	426-L37AD02-01S	AC JACK BRACKET	1.000000	Piece	S
16>	521-030091-01	FELT PAPER 30X9X1.0MM W/ ADHESIVE	8.000000	Piece	S
17>	521-550155-01	FELT PAPER 550X15X0.5MM W/ ADHESIVE	2.000000	Piece	S

Spare part list for LCT42Z6TM

18>	521-950155-01	FELT PAPER 950X15X0.5MM W/ ADHESIVE	2.000000	Piece	S
19>	522-421D01-01	MASKING PAPER	1.000000	Piece	S
20>	560-L42AE01-03AP	MODEL LABEL AKAI LCT42Z6TM (B) MST9U89AL USA P	1.000000	Piece	S
21>	563-119-	SERIAL NO. LABEL	1.000000	Piece	S
22>	568-P46T02-02	WARNING LB ENG 42SF NIL	1.000000	Piece	S
23>	578-L42AE01-01AP	FUNCTION SHEET FOR TERMINAL LCT42Z6TM MST9U89AL P	1.000000	Piece	S
24>	579-42D102-09	SERIAL NO/BAR CODE LABEL 42D1	1.000000	Piece	S
25>	579-42D105-01	PROTECTIVE EARTH LABEL FOR ESA 42TD1	1.000000	Piece	S
26>	579-L27AD09-01	CAUTION LABEL ENG AKAI	1.000000	Piece	S
27>	579-L32AD09-02AP	FCC STATEMENT LABEL 77X20MM	1.000000	Piece	S
28>	579-L42AE01-01AP	BAR CODE LABEL AKAI LCT42Z6TM USA P	2.000000	Piece	S
29>	590-L42AE01-01AP	WARRANTY CAR AKAI ENG LCT42Z6TM USA P	1.000000	Piece	S
30>	593-L42AE01-01AP	INSERTION CARD AKAI ENG LCT42Z6TM USA P	1.000000	Piece	S
31>	599-L42AE01-01AP	IB SHEET E FOR LCT42AE STAND(BP04) USA (RS)	1.000000	Piece	S
32>	E3404-157004	AC CORD UL 1.88M (YY-3/ST3 YUNBIAO)	1.000000	Piece	S
33>	E3421-925103	WIRE ASSY TJC3-4Y 800MM FOR LCT27 & 32AB SPEAKER S.V.	1.000000	Piece	S
34>	E3421-925104	WIRE ASSY PH2.0-2Y L=600MM 32AB KEY S.V.	1.000000	Piece	S
35>	E3421-925105	WIRE ASSY PH2.0-4Y 720MM 32AB KEY S.V.	1.000000	Piece	S
36>	E3421-925153	WIRE ASSY 250MM 3WIRES 20# 1617 FOR POWER IN PUT	1.000000	Piece	S

Spare part list for LCT42Z6TM

37>	E3421-925192	WIRE INVERTER 10P/2.5+12P/2.0 L350MM LPL (V420H1-L05) MST9U89AL	1.000000	Piece	S
38>	E3421-925194	WIRE ASSY 1H3.96-2H2.5/2.0 L350 AG 9/11+10+9+4P MST9U89AL	1.000000	Piece	S
39>	E3421-925196	WIRE INVERTER 10P/2.5+12P/2.0 +4P/2.5 LA700MM LB400MM LPL (LC420WUI)	1.000000	Piece	S
40>	E3471-000087	WIRE WS SHIELD WIRE L=330MM FOR 42" LPL LC420WUI S.V. MST9U89AL USA	1.000000	Piece	S
41>	E4801-124001	SPEAKER 8 OHM 10W D3" YD78-1	2.000000	Piece	S
42>	E6203-42PD01	DISPLAY LCD 42" LPL WUXGA TFT LC420WU1-SLA2	1.000000	Piece	S
43>	E7301-010002	BATTERY AAA R03P1.5V <2>	2.000000	Piece	S
44>	G300-L42AE03-02CA	ROHS POLYFOAM BOTTOM RS (SHANG HAO)	1.000000	Piece	S
45>	G300-L42AE04-02CA	ROHS POLYFOAM TOP RS (SHANG HAO)	1.000000	Piece	S
46>	G436-L42AE01-01SA	ROHS TERMINAL SHEET SMART VISION(TOMEI)	1.000000	Piece	S
47>	G481-L42AE02-01SA	ROHS SHIELD BOTTOM SMART VISION L42AE(TOMEI)	1.000000	Piece	S
48>	G483-L42AE01-01A	ROHS SHIELD COVER (TOMEI)	1.000000	Piece	S
49>	734-BP0403-02	PLASTIC STAND FOR 421D CD=460MM W/PACKING EXPLODE H=270MM MATT BLACK	1.000000	SET	S
50>	771BL42AE01-01	IR RECEIVE PCB ASS'Y FOR LCT42AE S-MST9U89AL USA	1.000000	SET	S
51>	771KL42AE01-01	KEY PCB ASS'Y FOR LCT42AE S- MST9U89AL USA	1.000000	SET	S

PROGRAM guide for model:LCT42Z6TM:

Step 1 :

Use the cable adaptor (show in photo 1) Printer port plug connect to your PC, the VGA Jack connect to LCT42Z6TM Monitor VGA socket.

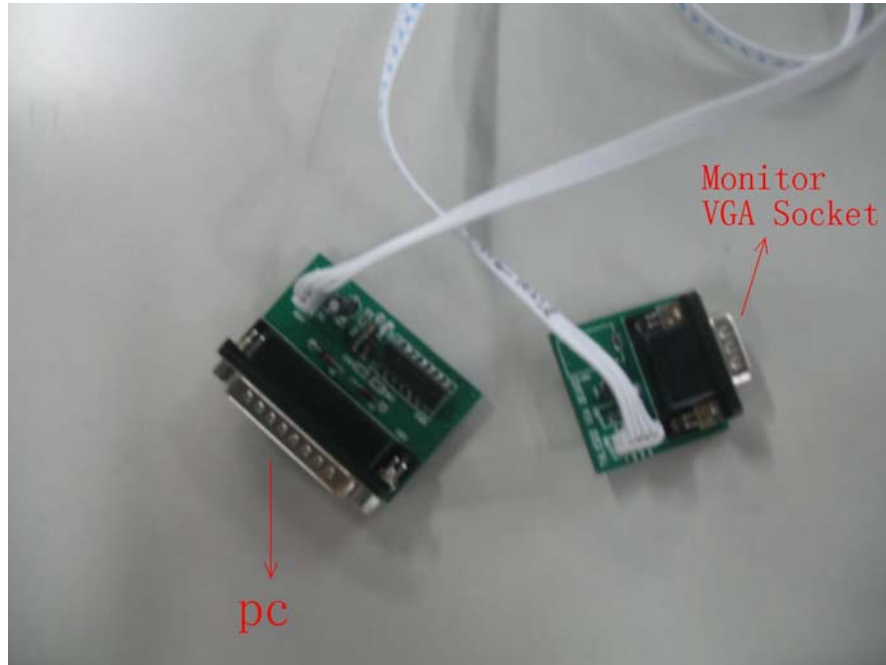


photo 1

Step 2 :

Expend “ISP_tool.rar”, then run “ISP_tool V4.0.5.exe ” program with your PC.

Your PC will appear photo 2 window.

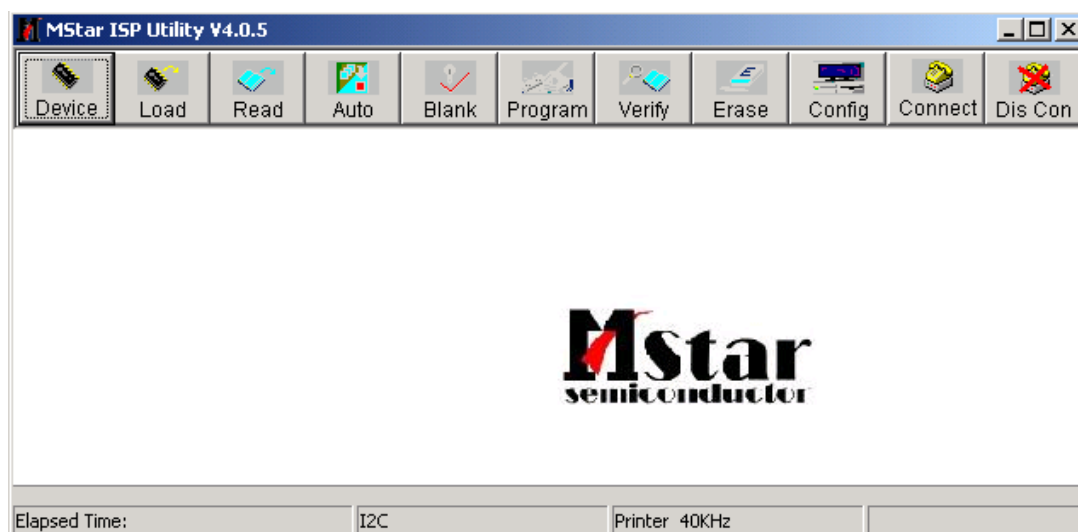


photo 2

Step 3:

Click “Read” button and select “MST_FLASH_512.Bin” file to load CODE data.

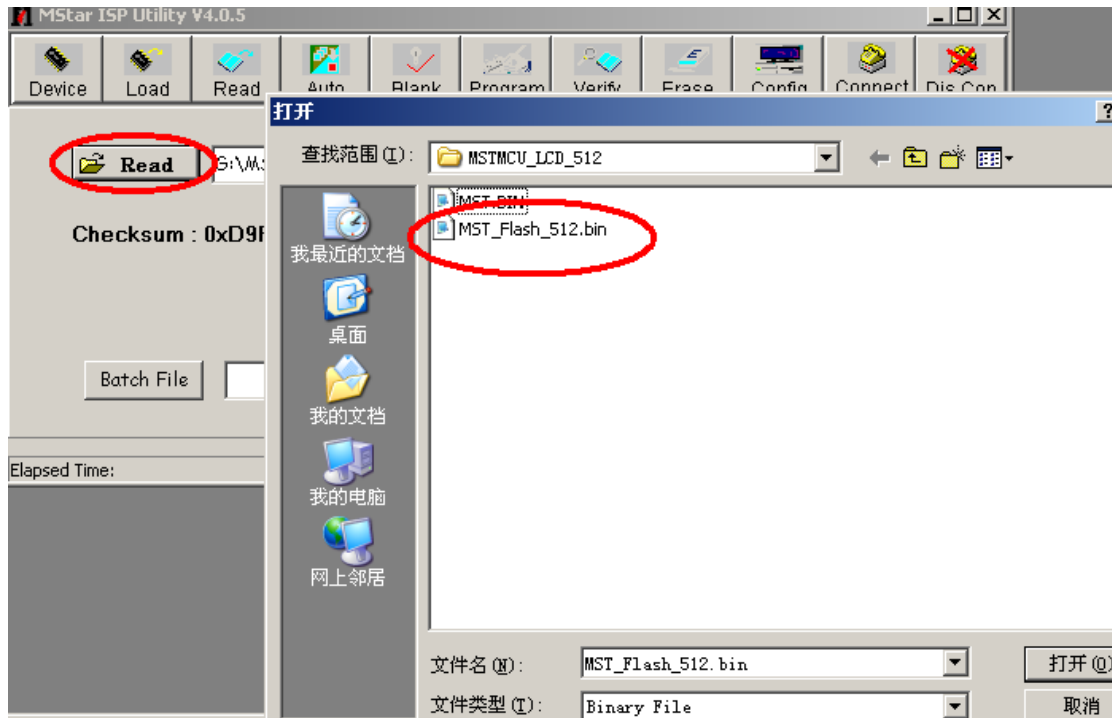


photo 3

Step 4:

Click “Connect” Button, connect your PC

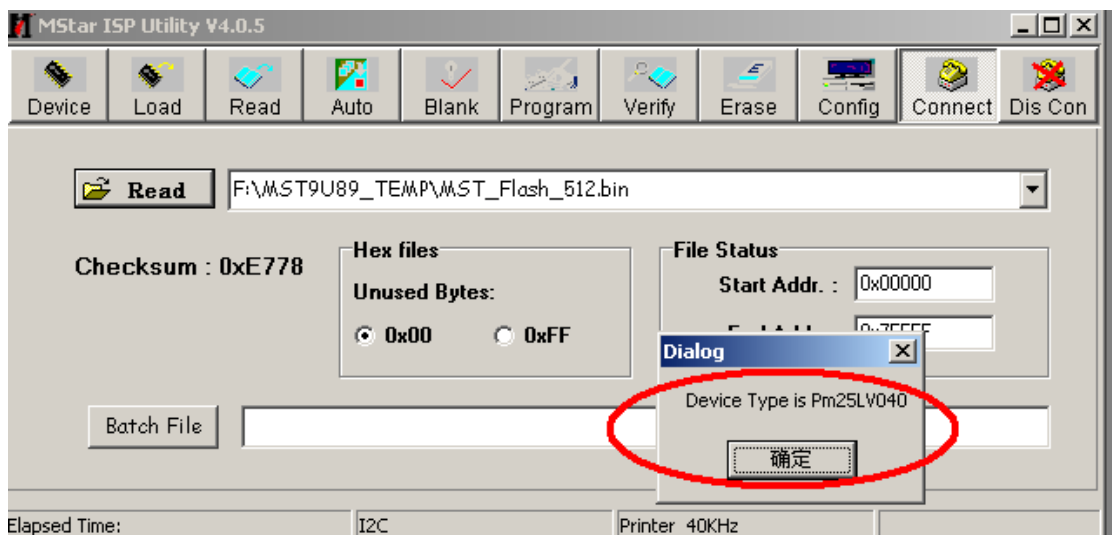


photo 4

Notice: if connecting fail, it will show a message like the [photo 5](#)

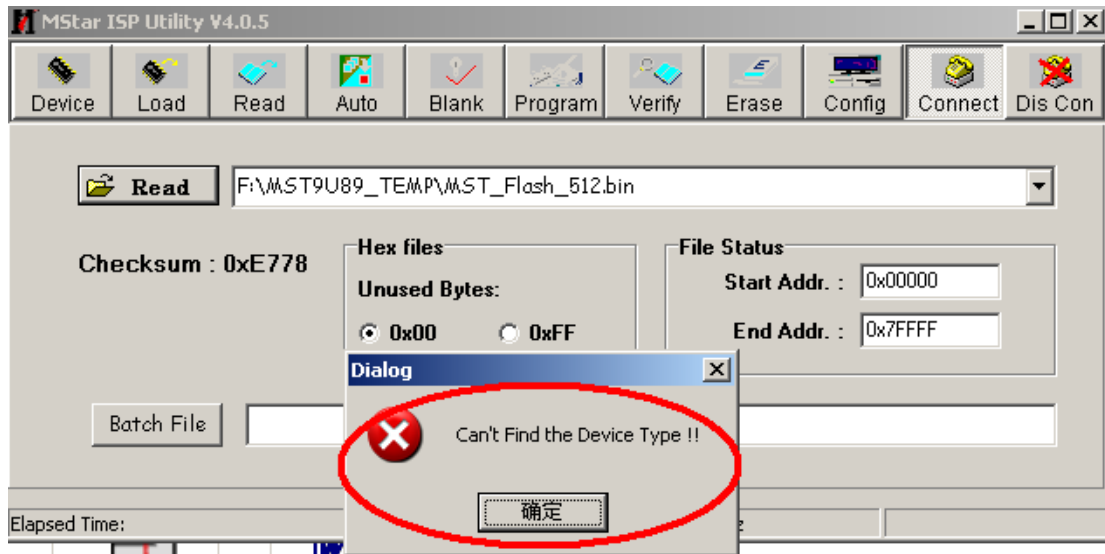


photo 5

Step 5:

when all of the step is correct to run, Click “Auto” Button, it will go to the Program state, then Click “Run” Button, it will finish the installation automatic

Notice: if this step fail, press “run” button again, till the installation is ok

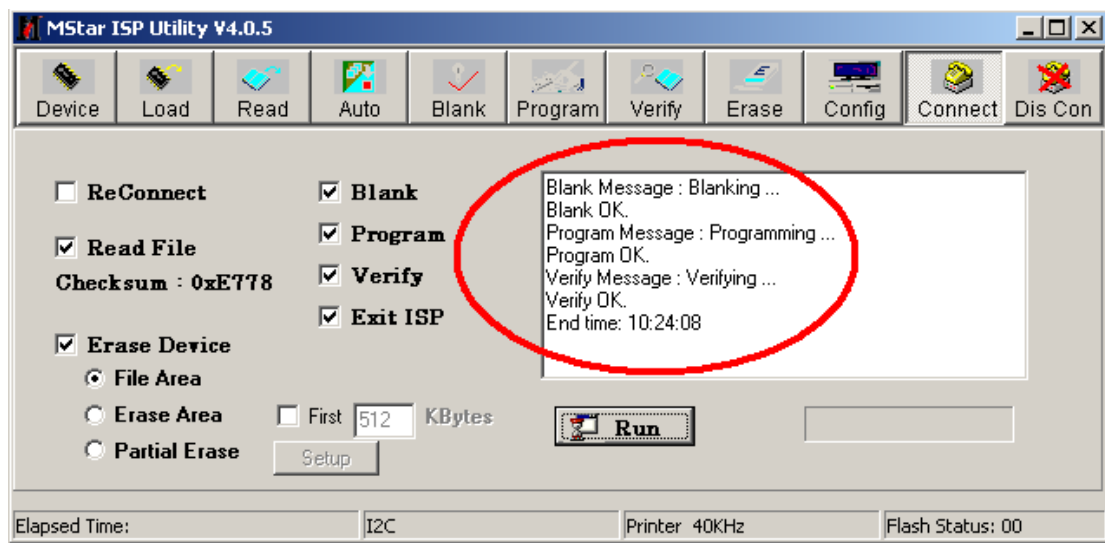


photo 6

Step 6:

After the installation is finished, please turn off the power, waiting the LED of the monitor is turning off before you use the monitor.

The end