

SPECIFICATION

for LCM

Customer	(주) 햄팩스
Model No.	VMS430HF02
Issued Date	October, 18, 2007

Any Modification of Spec is not allowed without VODATECH's permission.

SUPPLIER APPROVAL

DESIGNED	CHECKED	APPROVED
		
REMARKS :		

CUSTOMER APPROVAL

DESIGNED	CHECKED	APPROVED
REMARKS :		

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[REVISION RECORD]

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0	October,18 , 2007	Initial released	All	

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1. Scope

This specification defines overall terms and inspection standards for LCD modules supplied by VODA tech Co.,Ltd.

If the event of unexpected problems or unspecified items may occur, we will negotiate and agree to solutions with customer.

2. Features

- TM (Transmissive) type and back-light with 7 LED's are available.
- TN(Twist Nematic) mode.
- Line inversion mode with stripe type.
- 24bit RGB Interface
- Low Power consumption.
- Resistive Type TSP

3. General Description

VMS430HF02 is a color active matrix TFT liquid crystal display (LCD) that uses amorphous silicon TFT as a switching devices.

This model is composed of a TM(Transmissive) and Negative type Main TFT-LCD Panel and a driver circuit unit.

The resolution of a 4.3" Main LCD contains 480 x 272 pixels can display up to 16M colors.

Items	Specification	Unit	Note
Display area	95.04(H) x 53.86(V)	mm	-
Driver element	a-Si TFT active matrix	-	-
Display colors	16.7M	colors	-
Number of pixels	480RGB(H) x 272(V)	dot	-
Pixel arrangement	Stripe type	-	-
Pixel pitch	0.198(H) x 0.198(V)	mm	-
Display mode	Normally White	-	-
Viewing direction	6	o'clock	-

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4. Mechanical Specifications

Item		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal(H)	105.2	105.5	105.8	mm	-
	Vertical(V)	66.9	67.2	67.5	mm	(1)
	Depth(D)	3.80	3.95	4.10	mm	(1)
Weight		-	20	22	g	-

Note (1) Not include FPC.

Refer to the Outline Dimension in the "12.Outline Dimension" for further information.

5. Absolute Maximum Ratings (Ta = 25℃)

Characteristics	Symbol	Min.	Max.	Unit	Note
Digital Logic Power Supply	DVDD	-0.3	6	V	-
Analog Power Supply	AVDD	-0.3	6	V	-
Logic Input Voltage	V _{I1}	-0.3	DVDD + 0.3	V	-
Operation ambient Temperature	T _a	-20	60	℃	
Storage Temperature	T _{stg}	-30	70	℃	

Note 1) DVDD , AVDD are based on GND (0V).

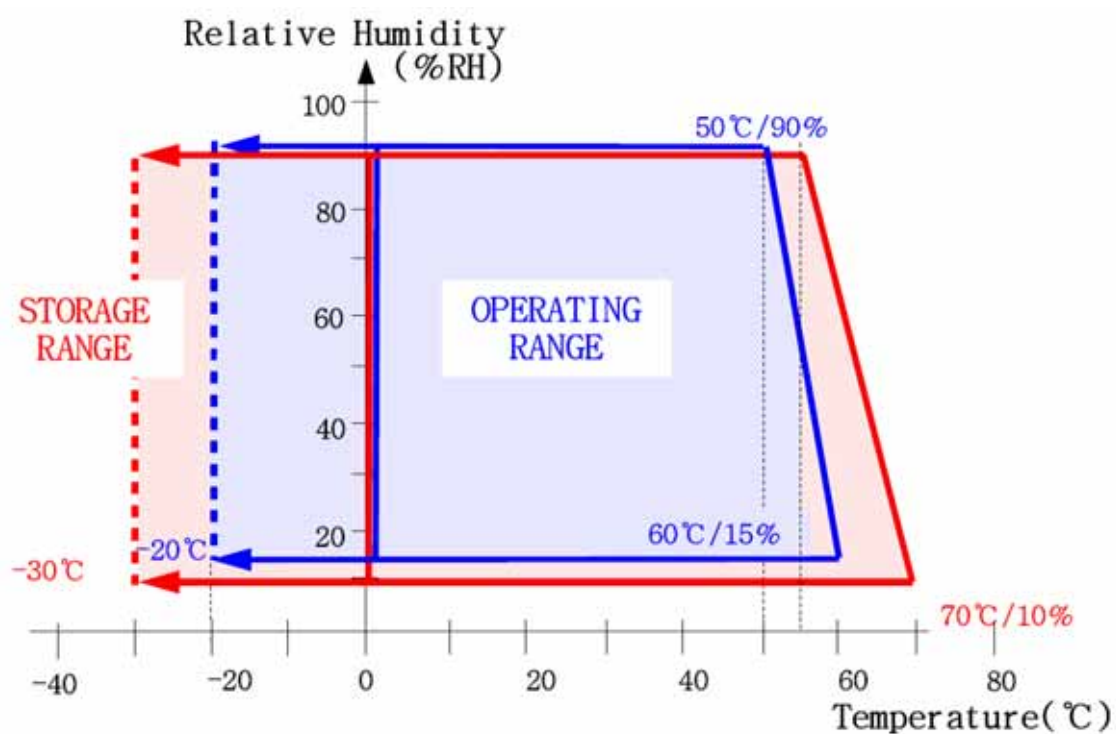
Note 2) If voltage supply exceeds its absolute maximum rating , that LCM may be damaged Permanently.

It is desirable to use this LCM under electrical characteristic conditions during operating. Otherwise, this LCM may cause malfunctions or reduced reliabilities.

Note 3) 95% RH MAX. (40℃≥Ta)

Maximum wet-bulb temperature at 39℃ or less.(Ta > 40℃, No condensation)

Note 4) In case of below 0℃, the response time of liquid crystal becomes slower and the color of panel becomes darker than normal one.



6. Electrical Characteristics

(Ta = 25°C)

Characteristics		Symbol	Min.	Typ.	Max.	Unit	Note
Digital Power Supply voltage		DVDD	3.1	3.3	3.5	V	-
Analog Power supply voltage		AVDD	4.8	5	5.2	V	-
Power Dissipation	Black	P	-	41.25	50	mW	(1),(2)
	White	P _{FULL}		38.75	45		
Current Dissipation	Black	I	-	16.5	20	mA	
	White	I _{FULL}		15.5	18		
Frame frequency		f _{Frame}	-	70	-	Hz	-
Dot Clock		DOTCLK	-	9.7	15	MHz	-

(1) DVDD = 3.3V, f_{Frame} = 70Hz, DOTCLK = 9.7MHz

(2) Dissipation current check pattern

7. Touch Screen Panel Specifications

7-1. Electrical Characteristics

Item	Min.	Typ.	Max.	Unit	Note
Linearity	-	-	1.5	%	Analog X and Y directions
Terminal resistance	200	-	900	Ω	X(Glass side)
	100	-	800	Ω	Y(Film side)
Insulation resistance	20	-	-	M Ω	DC 25V
Voltage	-	-	7	V	DC
Chattering	-	-	10	ms	100k Ω pull-up
Transparency	-	80	-	%	-

Caution (1) : Do not operate it with a thing except a polyacetal Stylus.

(tip R0.8mm or less) or a finger, especially those with hard or sharp tips such as a ball point pen or a mechanical pencil.

7-2. Mechanical & Reliability Characteristics

Item	Min.	Typ.	Max.	Unit	Note
Activation force	3	-	110	g	(1)
Durability-surface scratching	Write 100,000	-	-	characters	(2)
Durability-surface pitting	1,000,000	-	-	touches	(3)
Surface hardness	3	-	-	H	JIS K5400

Note (1) Stylus : R0.8 Polyacetal .

Finger : R8.0 Hs40 Silicon rubber.

(2) Measurement for Surface area

- Stylus Pen has Center point of TSP Area.

- Force :110g

- Speed : 2times per second

(3) Each Touch by Silicon rubber R8.0 & 500gf load

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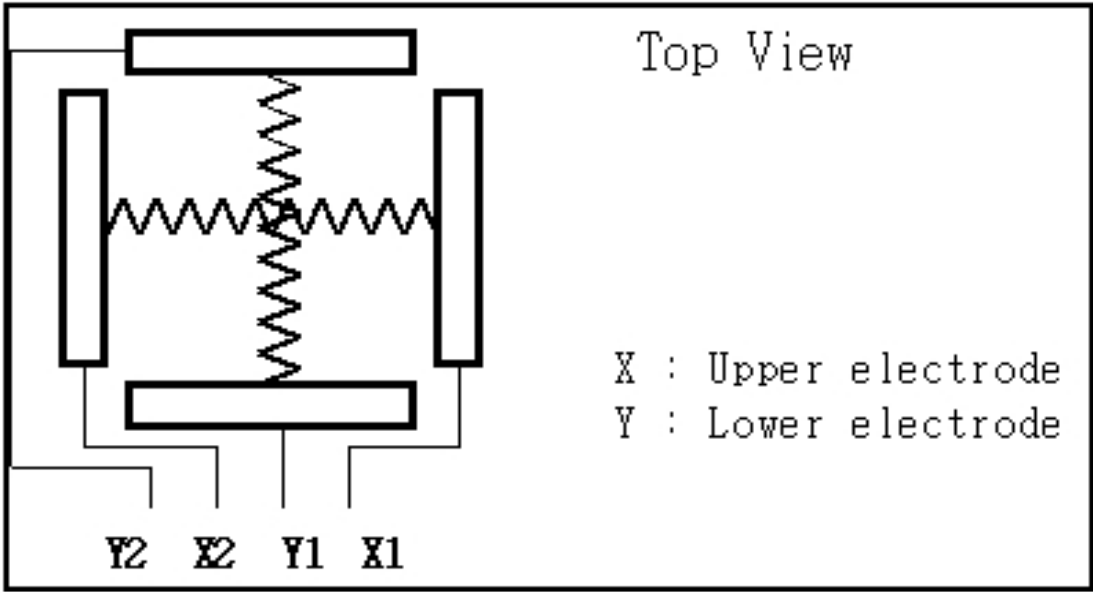
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7-3. Touch Screen Pin Position



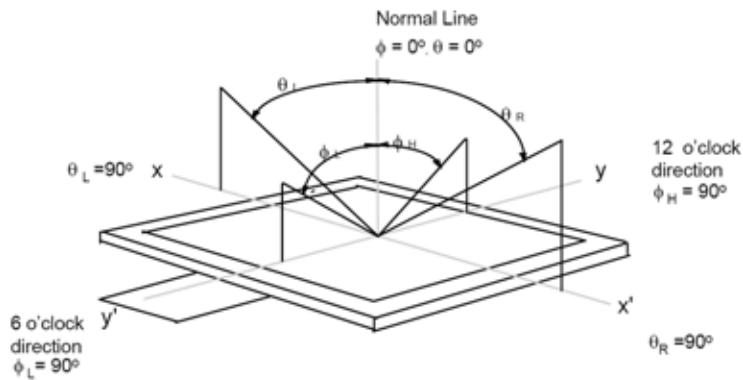
8. Electro – Optical Characteristics

The following items are measured under stable conditions. The optical characteristics should be measured in a dark room or equivalent state with the methods shown in Note 6).

(Temp = 25 ± 2°C, DVDD = 3.3V, AVDD = 5V, I_B = 20mA)

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast ratio (Center point)		C/R	Note(1) $\Theta = 0$ $\Phi = 0$ Normal Viewing Angle B/L=ON (With TSP)	150	250		-	(2) BM-5A
Luminance of white (Center point)		YL		300	350		cd/m ²	(7) CA-210
Uniformity		-		70	-	-	%	(6),(7) BM-7
Response time	Rising:Tr	Tr+Tf		-	50	70	msec	(3)
	Falling:Tf							
Color Gamut		S		55	-	-	%	(5),(7) CA-210
Color Chromaticity (CIE1931)	White	Wx		0.27	0.32	0.37	-	
		Wy		0.29	0.34	0.39		
	Red	Rx		0.54	0.59	0.64		
		Ry		0.31	0.36	0.41		
	Green	Gx		0.31	0.36	0.41		
		Gy		0.54	0.59	0.64		
	Blue	Bx		0.09	0.14	0.19		
		By		0.05	0.10	0.15		
Viewing angle	Hor.	Θ_L	C/R B/L On (With TSP)	-	60	-	Degrees	
		Θ_R		-	60	-		
	Ver.	Φ_L		-	50	-		
		Φ_H		-	55	-		

Note 1) Definition of ϕ and θ

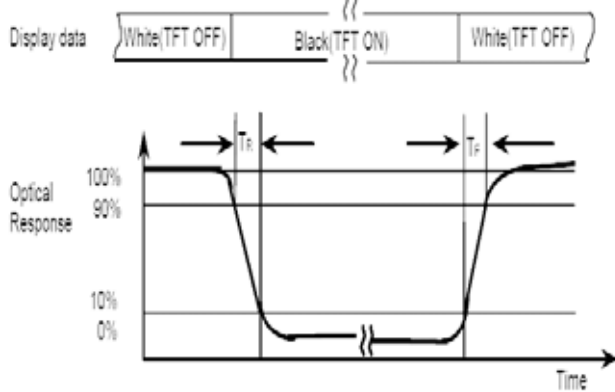


Note 2) Contrast ratio(C/R)

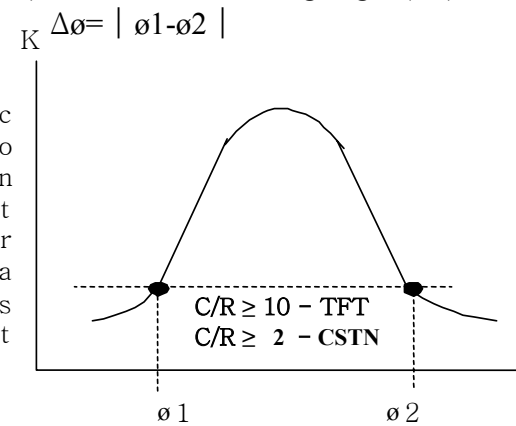
$$C/R = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

On the Panel

Note 3) Definition of response time
[Vertical]

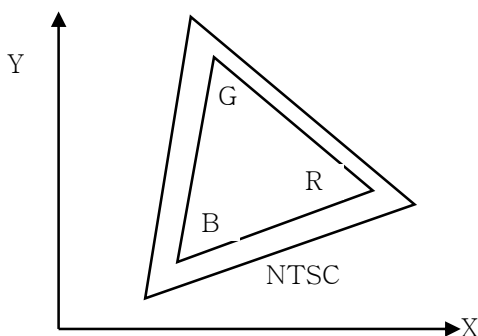


Note 4) Definition of viewing angle ($\Delta\theta$)

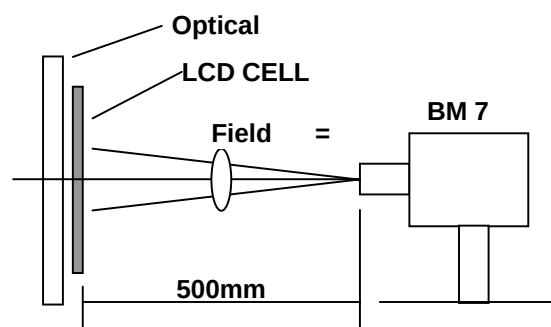


Note 5) The definition of color Gamut

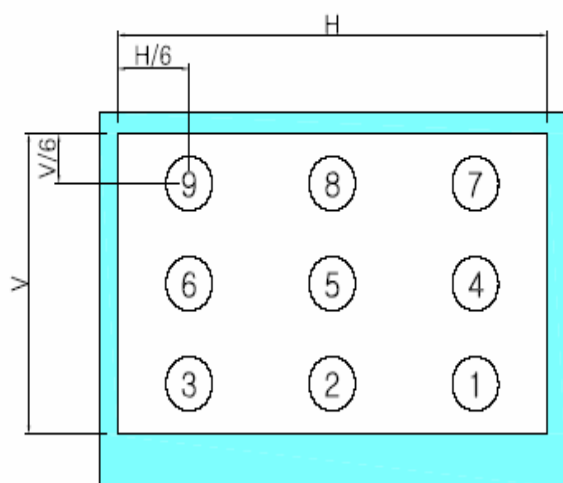
Color Gamut: $S(\%) = \frac{\text{RGB Triangle Area}}{\text{NTSC Triangle Area}} \times 100\%$



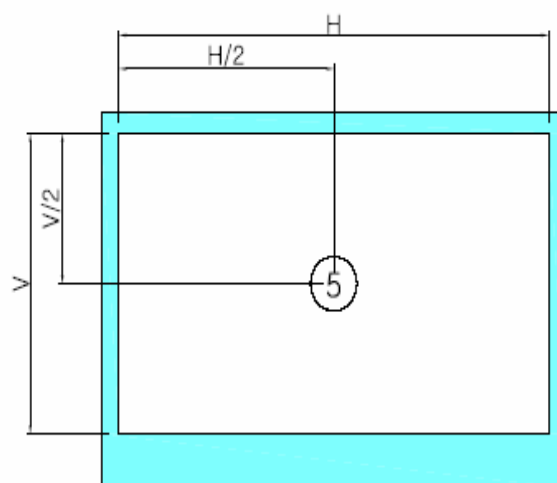
Note 6) Optical measuring system
(Temperature regulated chamber)



Note 7) Measurement point for luminance and luminance uniformity



[Measurement Point for Luminance Uniformity]



[Measurement Point for Surface Luminance]

9. I/O Terminals & Operating Sequence

9-1. Input Signal & Power (Connector : Molex -SD-51296-4541)

Pin NO	Pin Name	Discription	Pin NO	Pin Name	Discription
1	GND	Ground	26	D16_(B0_LSB)	DATA_B0~ DATA_B7
2	LED Anode	Led Anode pin	27	D17(B1)	
3	LED_Anode	Led Anode pin	28	D18(B2)	
4	LED_Cathode	Led Cathod pin	29	D19(B3)	
5	LED_Cathode	Led Cathod pin	30	D20(B4)	
6	X1	Touch pnl' pin(X+)	31	D21(B5)	
7	Y1	Touch pnl' pin(Y+)	32	D22(B6)	
8	X2	Touch pnl' pin(X-)	33	D23(B7)	System Reset
9	Y2	Touch pnl' pin(Y-)	34	RESET	
10	D0_(R0_LSB)	DATA_R0~ DATA_R7	35	DISP	Display on signal
11	D1(R1)		36	DCLK	RGB Interface dot clock
12	D2(R2)		37	DE	Data enable signal
13	D3(R3)		38	VSYNC	Vertical sync signal
14	D4(R4)		39	HSYNC	Horizontal sync signal
15	D5(R5)		40	AVDD	Analoge input power signal(5V)
16	D6(R6)		41	AVDD	Analoge input power signal(5V)
17	D7(R7)		42	DVDD	Digital input power signal(3.3V)
18	D8_(G0_LSB)	DATA_G0~ DATA_G7	43	DVDD	Digital input power signal(3.3V)
19	D9(G1)		44	GND	Ground
20	D10(G2)		45	GND	Ground
21	D11(G3)				
22	D12(G4)				
23	D13(G5)				
24	D14(G6)				
25	D15(G7)				

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9-2. Input Signal, Basic Display Colors and Gray Scale of Each Colors (16M colors)

COLOR	DISPLAY	DATA SIGNAL																												GRAY SCALE LEVEL
		RED								GREEN								BLUE												
		R0	R1	R2	R3	R4	R5	R6	R7	G0	G1	G2	G3	G4	G5	G6	G7	B0	B1	B2	B3	B4	B5	B6	B7					
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	0	0	-		
	BLUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	-			
	GREEN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	-			
	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	1	-			
	RED	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-			
	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	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	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	1	-			
GRAY SCALE OF RED	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	0	R0			
	DARK ↑	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R1			
		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R2			
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	R3~R252			
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:					
	LIGHT ↓	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R253			
		0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R254			
	RED	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R255			
GRAY SCALE OF GREEN	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	0	G0			
	DARK ↑	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G1			
		0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G2			
		:			:	:	:	:	:	:			:	:	:	:	:	:			:	:	:	:	:	:	G3~G252			
		:			:	:	:	:	:	:			:	:	:	:	:	:			:	:	:	:	:					
	LIGHT ↓	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	G253			
		0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	G254			
	GREEN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	G255			
GRAY SCALE OF BLUE	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	0	B0			
	DARK ↑	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	B1			
		0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	B2			
																											B3~B252			
	LIGHT ↓	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	B253			
		0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	B254			
	BLUE	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	B255			

Note) Definition of Gray :

Rn : Red Gray, Gn : Green Gray, Bn : Blue Gray (n = Gray level)

Input Signal : 0 = Low level voltage, 1 = High level voltage

8-3. Block Diagram

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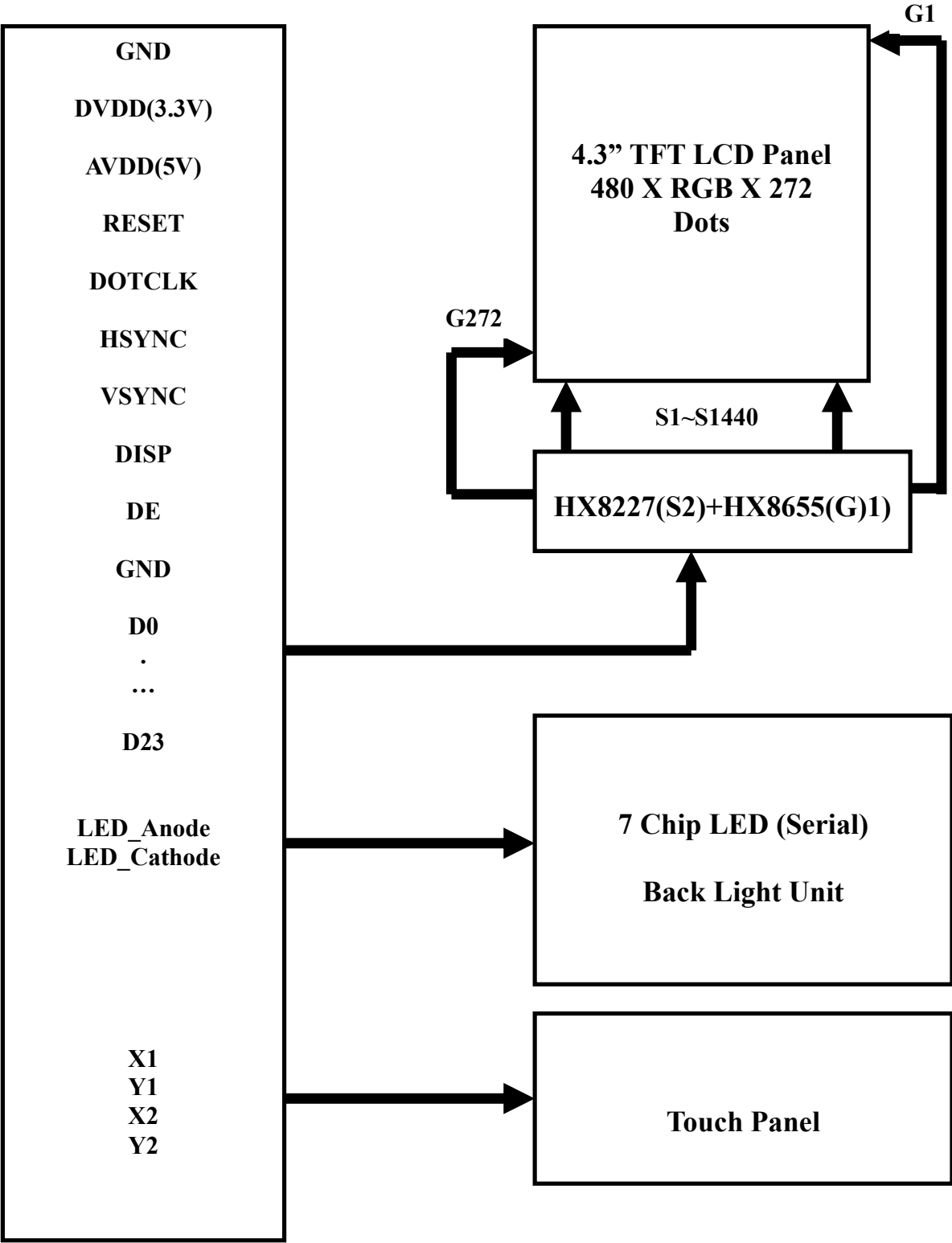
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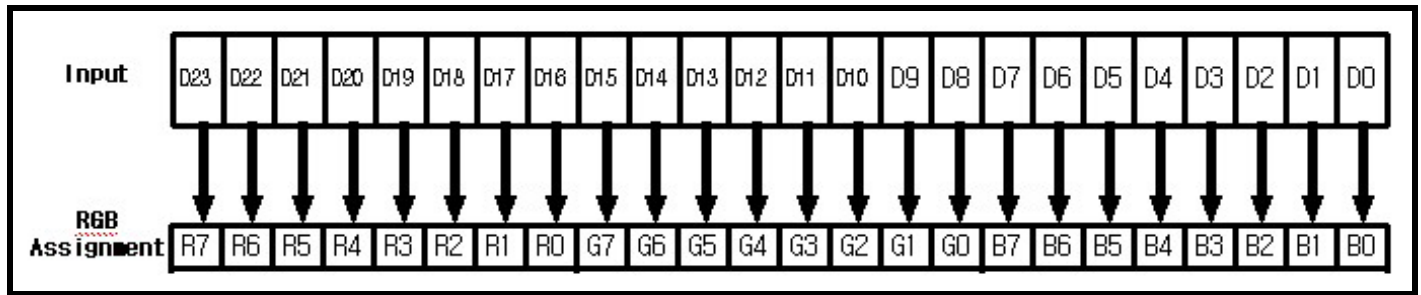
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[24-bits RGB Interface]

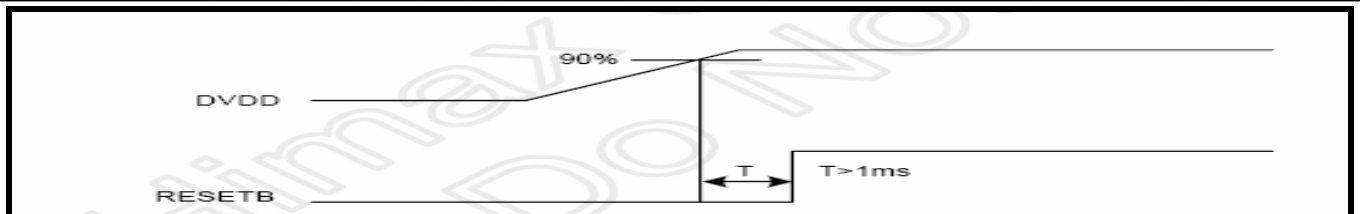
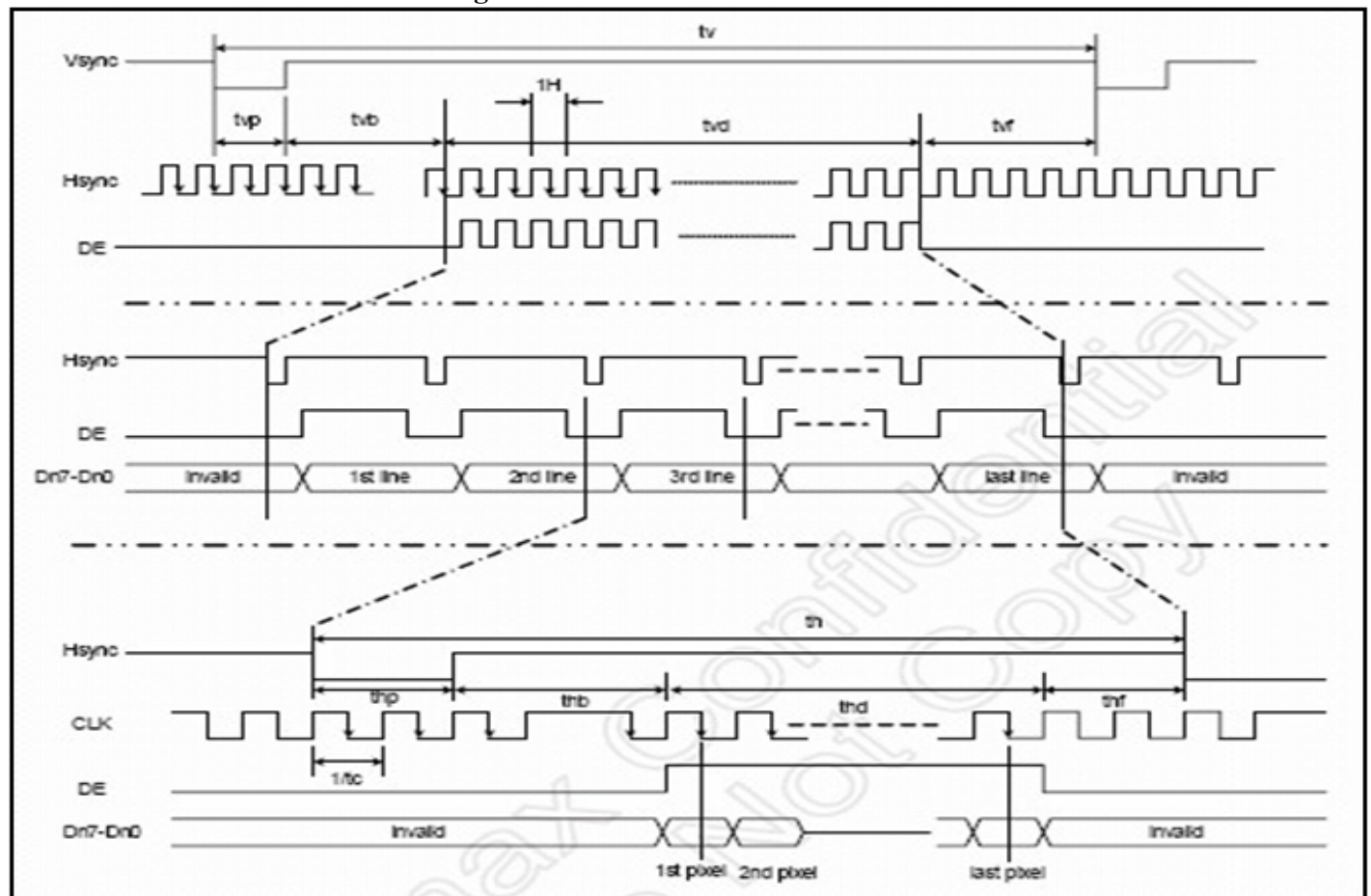


9-4. Interface Timing

* Data Format for 24bit RGB Interface



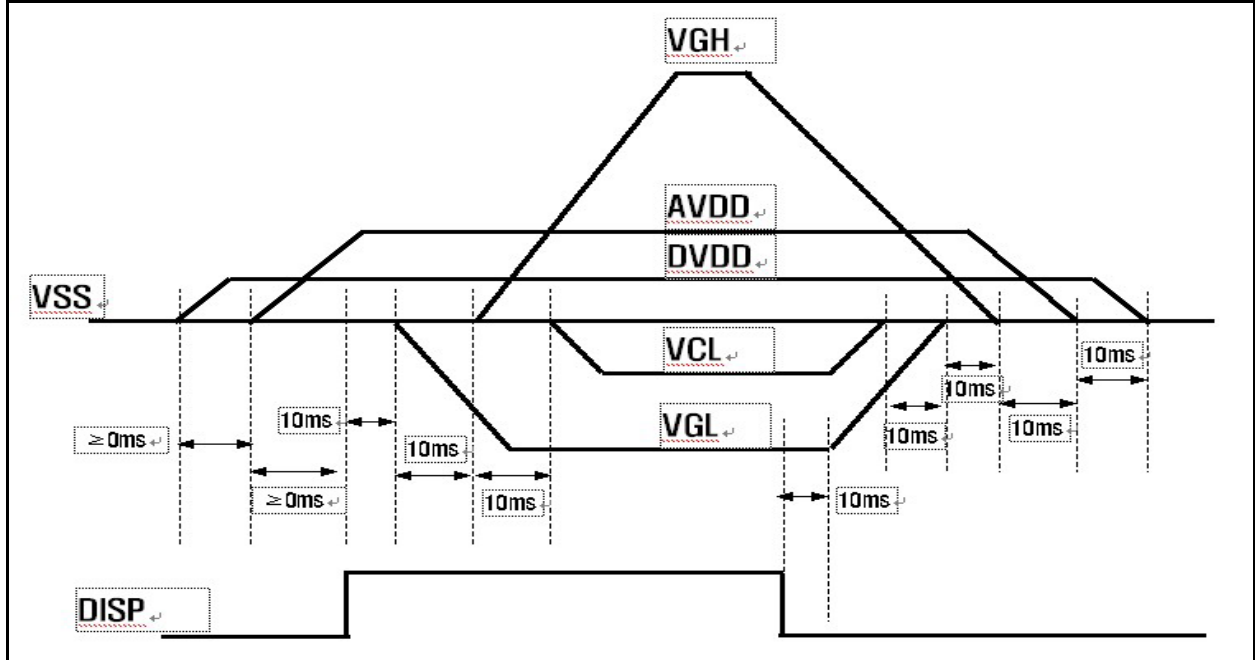
*24bit RGB Interface Timing



480RGB X 272 , Ta = 25°C , DVDD = 3.3V , VSS = 0V

Parameter	Symbol	Min.	Typ.	Max.	Unit
Clock Cycle	1/Tc	-	9	15	MHz
Hsync Cycle	1/fH	-	17.14	-	KHz
Vsync Cycle	1/fv	-	59.94	-	Hz
Horizontal Signal					
Horizontal Cycle	Th	-	525	-	CLK
Horizontal Display Period	Thd	-	480	-	CLK
Horizontal Front Porch	Thf	2	-	-	CLK
Horizontal Pulse Width	Thp	2	41	-	CLK
Horizontal Back Porch	Thb	2	2	-	CLK
Vertical Signal					
Vertical Cycle	Tv	-	286	-	H
Vertical Display Period	Tvd	-	272	-	H
Vertical Front Porch	Tvf	1	2	-	H
Vertical Pulse Width	Tvp	1	10	-	H
Vertical Back Porch	Tvb	1	2	-	H

9-5. . Power ON/OFF Sequence



Note 1. VGH , VGL , VCL – Voltage for Operating TFT Panel.

10. Quality Specifications

10-1. Acceptable Quality Level (AQL)

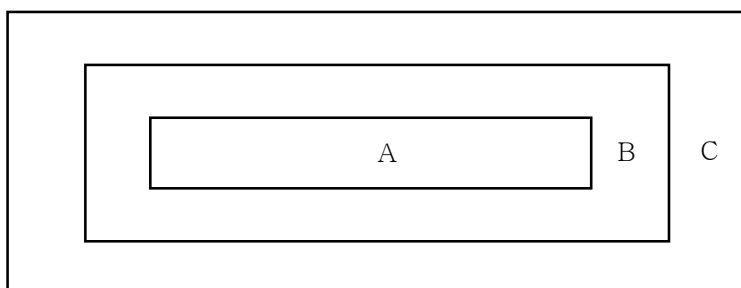
Defect type	Sampling procedures	AQL
Major	MIL-STD-105E Inspection level II normal inspection single sample inspection	0.65%
Minor	MIL-STD-105E Inspection level II normal inspection single sample inspection	1.5%

- Major defect :
A major defect refers to a defect which is not considered to substantially degrade usability for product applications.
- Minor defect :
A minor defect refers to a defect which is not considered to substantially degraded product application, or a defect which deviates from existing standards almost unrelated to the effective use of the product or it's operation.

10-2. Inspection conditions

- The environmental conditions for inspection shall be as follows.
Room temperature : $25 \pm 5^{\circ}\text{C}$
Humidity : $65 \pm 10\%\text{RH}$
- The external visual inspection
The inspection shall be performed by using a single 20W fluorescent lamp for illumination and the distance from LCD to eyes of the inspector should be 50cm or more.

10-3. Definition of inspection zone in LCD



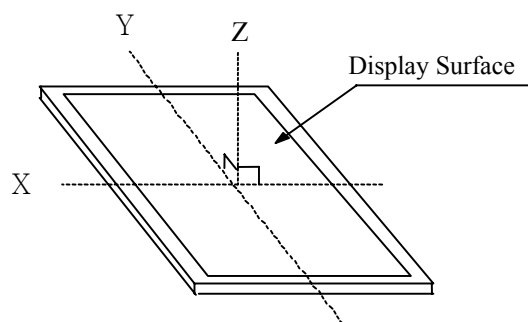
Zone A : Character/Digit area
Zone B : Viewing area
(Except zone A)
Zone C : Outside viewing area
(Invisible area after assembly in customer's products)

10-4. Inspection method

10-4-1 Definition of Dark/Bright Spot or Line

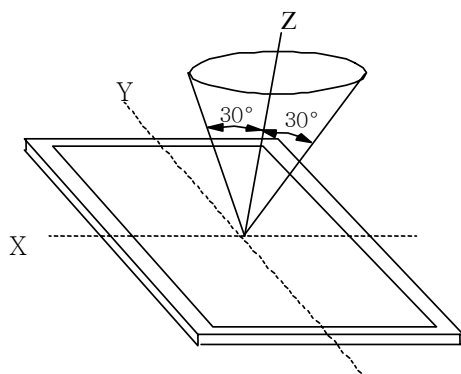
ITEM	Criterion for defects
Dark/Bright Spot (Stain,Dust)	Points on the display which appear dark/bright and remain unchanged in size
Dark/Bright Line (lint)	Lines on the display which appear dark/bright and remain unchanged in size

(1) Light method



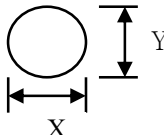
Fluorescent lamp set the perpendicular to the Display surface

(2) Inspection distance and angle



Inspection should be performed within $\varnothing$ ($\varnothing$ is usually 30°) from Z axis to each X and Y axis. Inspection distance of any direction within $\varnothing$ must be kept 50 ± 5 cm to the display surface.

10-5. Incoming Inspection standards

ITEM	Criterion for defects	Defect type																			
1) Display on Inspection	(1) Non display is not allowed (2) Irregular (abnormal) operations are not allowed (3) Shorts pattern is not allowed (4) Pattern open is not allowed (5) All kinds of line defect such as Vertical, Horizontal, Cross are not allowed (6) Over current is not acceptable (7) Maximum rating (8) No Back lighting is reject Backlight flickering and abnormal lighting are reject	Major																			
2) Dark/Bright Spot Pinhole,Foreign Particle Scratch (Main & Sub) $(\varnothing = (X+Y)/2)$ 	<table><tr><th rowspan="2">Zone Size(mm)</th><th colspan="3">Acceptable Q'ty</th></tr><tr><th>A,</th><th>B</th><th>C</th></tr><tr><td>$\varnothing<0.15$</td><td colspan="2">Acceptable</td><td rowspan="2">Acceptable</td></tr><tr><td>$0.15\leq\varnothing\leq0.5$</td><td colspan="2">4</td></tr></table> Note: NG if three or more spot crowd together	Zone Size(mm)	Acceptable Q'ty			A,	B	C	$\varnothing<0.15$	Acceptable		Acceptable	$0.15\leq\varnothing\leq0.5$	4		Minor					
Zone Size(mm)	Acceptable Q'ty																				
	A,	B	C																		
$\varnothing<0.15$	Acceptable		Acceptable																		
$0.15\leq\varnothing\leq0.5$	4																				
3) Dark/Bright Line Polarizer Scratch (Main & Sub)	<table><tr><th colspan="2">Size(mm)</th><th colspan="3">Acceptable Q'ty</th></tr><tr><th>Length(mm)</th><th>Width(mm)</th><th>A</th><th>B</th><th>C</th></tr><tr><td>$L\leq0.3$</td><td>$W\leq0.05$</td><td colspan="2">Acceptable</td><td rowspan="2">Acceptable</td></tr><tr><td>$0.3<L\leq2.0$</td><td>$0.05<W\leq0.1$</td><td colspan="2">4</td></tr></table>	Size(mm)		Acceptable Q'ty			Length(mm)	Width(mm)	A	B	C	$L\leq0.3$	$W\leq0.05$	Acceptable		Acceptable	$0.3<L\leq2.0$	$0.05<W\leq0.1$	4		Minor
Size(mm)		Acceptable Q'ty																			
Length(mm)	Width(mm)	A	B	C																	
$L\leq0.3$	$W\leq0.05$	Acceptable		Acceptable																	
$0.3<L\leq2.0$	$0.05<W\leq0.1$	4																			
4) Bubble in polarizer (Main & Sub)	<table><tr><th rowspan="3">Size(mm)</th><th colspan="3">Acceptable</th></tr><tr><th colspan="3">Zone</th></tr><tr><th>A</th><th>B</th><th>C</th></tr><tr><td>$\varnothing<0.3$</td><td colspan="2">Acceptable</td><td rowspan="2">Acceptable</td></tr><tr><td>$0.3\leq\varnothing\leq0.50$</td><td colspan="2">3</td></tr></table>	Size(mm)	Acceptable			Zone			A	B	C	$\varnothing<0.3$	Acceptable		Acceptable	$0.3\leq\varnothing\leq0.50$	3		Miner		
Size(mm)	Acceptable																				
	Zone																				
	A	B	C																		
$\varnothing<0.3$	Acceptable		Acceptable																		
$0.3\leq\varnothing\leq0.50$	3																				

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5) Dot	Size(mm)	Acceptable			Major
		Zone			
		A	B	C	
	Bright Dot	2		Accept- able	
	Dark Dot(Random)	3			
	Total Bright & Dark Dots	4			
6) Stains on LCD panel surface (Main & Sub)	Stains which cannot be removed even when wiped Lightly with a soft cloth or similar cleaning too are reject				Minor
7) Back-light (Main & Sub)	1)The brightness and color of Backlight should Correspond it is specification 2) Dust and black dot on Back light : $\phi \leq 0.20$.				Minor
8) Defect of land surface contact (Poor soldering) (Main & Sub)	Evident crevices which is visible are reject				Minor
9) Parts mounting (Main & Sub)	1) Failure to mount parts 2) Parts not in the specifications are mounted 3) Polarity is reversed				Minor
10) Parts alignment (Main & Sub)	1) LSI, IC lead width is more then 70% beyond pad outline. 2) Chip component is off center and more then 70% of the leads is off the pad outline.				Minor
11) Solder Ball. Solder chip (Main & Sub)	1) $0.45 < \phi$, $N \geq 1$ 2) $0.30 < \phi \leq 0.45$, $N \geq 1$ ϕ :Average diameter of solder ball(unit:mm)				Minor Minor
	3) $0.50 < L$, $N \geq 1$ L:Average length of solder chip(unit:mm)				Minor
12) Faulty PWB correction (Main & Sub)	1) Failure to stamp or label error, or not legible (all acceptable if legible) 2) The separation is more than 1/3 forbidden indication, Discoloration, In which the characters can be checked				Minor

11. Reliability

All test result of items should be judged in one hour recovery time.

ITEM	Conditions	Criteria
High temperature operating	60 °C , 96 hrs	- After testing, cosmetic and operational defects should not happen. - Contrast ratio should be within 90% of initial value. - Total current consumption should be below double of initial value.
Low temperature operating	-20 °C , 96 hrs	
High temperature storage	70 °C , 96 hrs	
Low temperature storage	-30 °C , 96 hrs	
Humidity	50 °C , 90%RH, 120 hrs	
Thermal shock	25 °C → -30 °C → 25 °C → 70 °C 5(min) 30(min) 5(min) 30(min) 3 cycle, 55 ~ 60%RH	
Temperature Humidity cycle	JIS.C.0028.1, 3 cycles	- Not allowed cosmetic & electrical defects - Test will be performed at state of carton box, not each module.
Vibration	Time : 1hrs Direction : x,y,z Frequency : 10~55~10Hz Amplitude : 1.5mm(double)	
Static electricity	150 Pf , 330 ohm , 8kV 3 times, air discharge	

12. General Precautions

12-1. Handling

- Assembled, LCD module should be firmly attached to the set.
Do not bent or twist.
- Refrain from strong mechanical shock and forces to the module.
It may cause improper operating or damage to the module.
- Do not touch, press or rub the display panel with hard or stiff tools or subjects.
The polarizer is easily damaged.
- Wipe off water or oil drop immediately
If you leave drop for a long time, stain and discoloration may occur.
- When cleaning the surface of polarizer, use soft cloth with solvent like Isopropyl or Ethyl alcohol or Hexane.
Do not use Water, Ketone, Acetone, Ethyl alcohol, Toluene, Ethyl acid, Methyl chloride.
- Be care full of applying HCFC, Chlorine(CL), Salfur(S), Spittle, Fingerprint to ITO pattern
These may cause ITO corrosion.
- When handling the LCD module, put on a soft glover like finger-glover.
- Protection film on the polarizer shall be slowly peeled off just before use,
so that the electrostatic charge can be minimized.
- Do not touch pads or pins of interface directly with bare hands.
- Protect the module from static electricity, it may cause damage to CMOS LSI.
- If the liquid crystal leaks from the panel it should be kept away from the eyes and mouths.
In case of contact with skins, wash away thoroughly with soap and water.

12-2. Operation

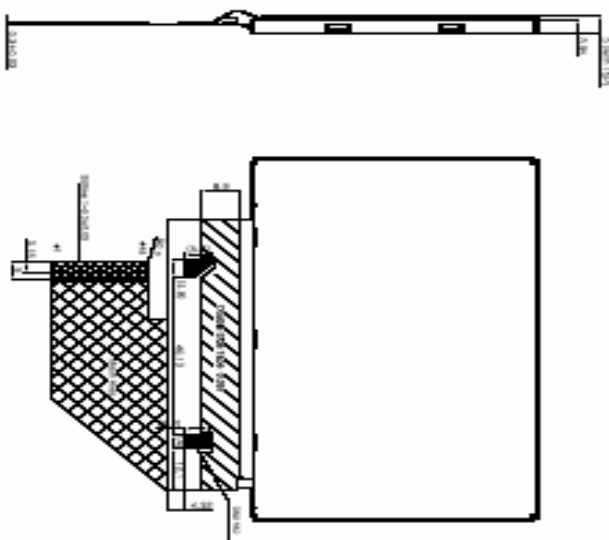
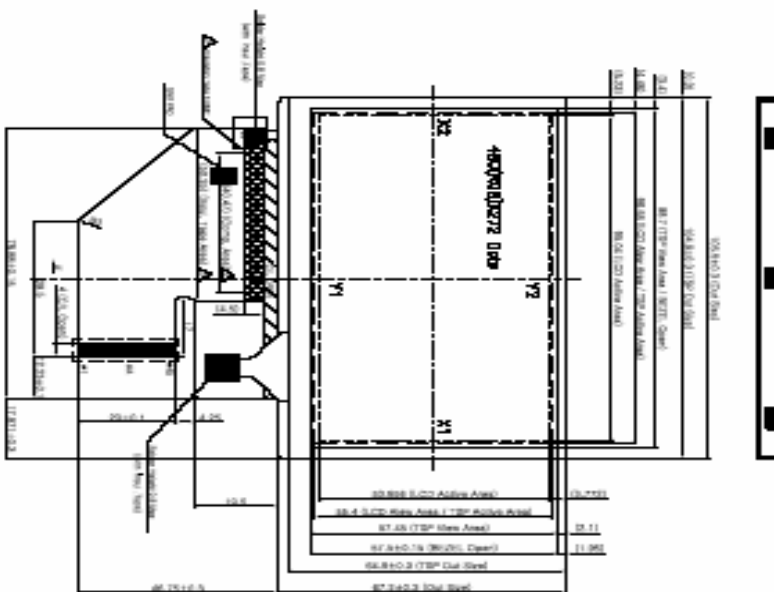
- Do not input any signals before power is turned on.
- Do not connect or disconnect the module on the state of Power-ON.
- Power supply should be turned on or off according to Power ON/OFF sequence.
- Supply voltage within the specified voltage limit, the maximum rating, higher voltage cause the shorter LCD life or damaged.
- Avoid condensation of water, It may cause improper operation or disconnection of electrode.
- Do not leave LCD module in direct sunlight and strong ultraviolet ray for many hours.
At that time the liquid crystal shall be deteriorated by ultraviolet.

12-3. Storage

- Do not leave the module in high temperature and humidity for a long time.
It is recommended to store the module in the place with temperature from 0 to 35℃
and relative humidity of less than 70%.
- Do not store the LCD module in the direct sunlight.
- Store the module in a dark place without sunlight and fluorescent.
- Avoid intensive shock and falls from a height.

13. Dimensional Outline

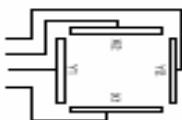
NO.	SWGL
1	SWGL
2	LED_Arcs
3	LED_Arcs
4	LED_Coroids
5	LED_Coroids
6	SWGL
7	SWGL
8	SWGL
9	SWGL
10	SWGL
11	SWGL
12	SWGL
13	SWGL
14	SWGL
15	SWGL
16	SWGL
17	SWGL
18	SWGL
19	SWGL
20	SWGL
21	SWGL
22	SWGL
23	SWGL
24	SWGL
25	SWGL
26	SWGL
27	SWGL
28	SWGL
29	SWGL
30	SWGL
31	SWGL
32	SWGL
33	SWGL
34	SWGL
35	SWGL
36	SWGL
37	SWGL
38	SWGL
39	SWGL
40	SWGL
41	SWGL
42	SWGL
43	SWGL
44	SWGL
45	SWGL



NO	MATERIAL NAME	CODE NO	SPECIFICATION	QTY	UNIT NO	REMARK
	LOH-4537			1		

Note

2. Resolution: $480 \times 320 \times 272$
3. Pixel size: $0.196(\mu\text{m}) \times 0.196(\mu\text{m})$
4. Masking Direction: $\pm$ C/Clock
5. Drive IC: Source: HX522/A_2aa / Gate: HX5655A_1aa
6. Back Light Units: LED 7 Chips / 20 mA
7. TSP Δ Glass: 0.35T (0.7T Glass)
8. Operating temp.: $-20^\circ\text{C} \sim 60^\circ\text{C}$
9. Storage temp.: $-30^\circ\text{C} \sim 70^\circ\text{C}$



4321
TSP CIRCUIT DIAGRAM

GENERAL TOLERANCE			
SIZE	LEVEL 1	LEVEL 2	LEVEL 3
0 < ϕ < 3	± 0.06	± 0.1	± 0.2
3 < ϕ < 6	± 0.08	± 0.15	± 0.3
6 < ϕ < 30	± 0.12	± 0.25	± 0.5
30 < ϕ < 120	± 0.25	± 0.4	± 0.8

[illegible]

PIXEL SIZE

Detail #A (S=2:1)

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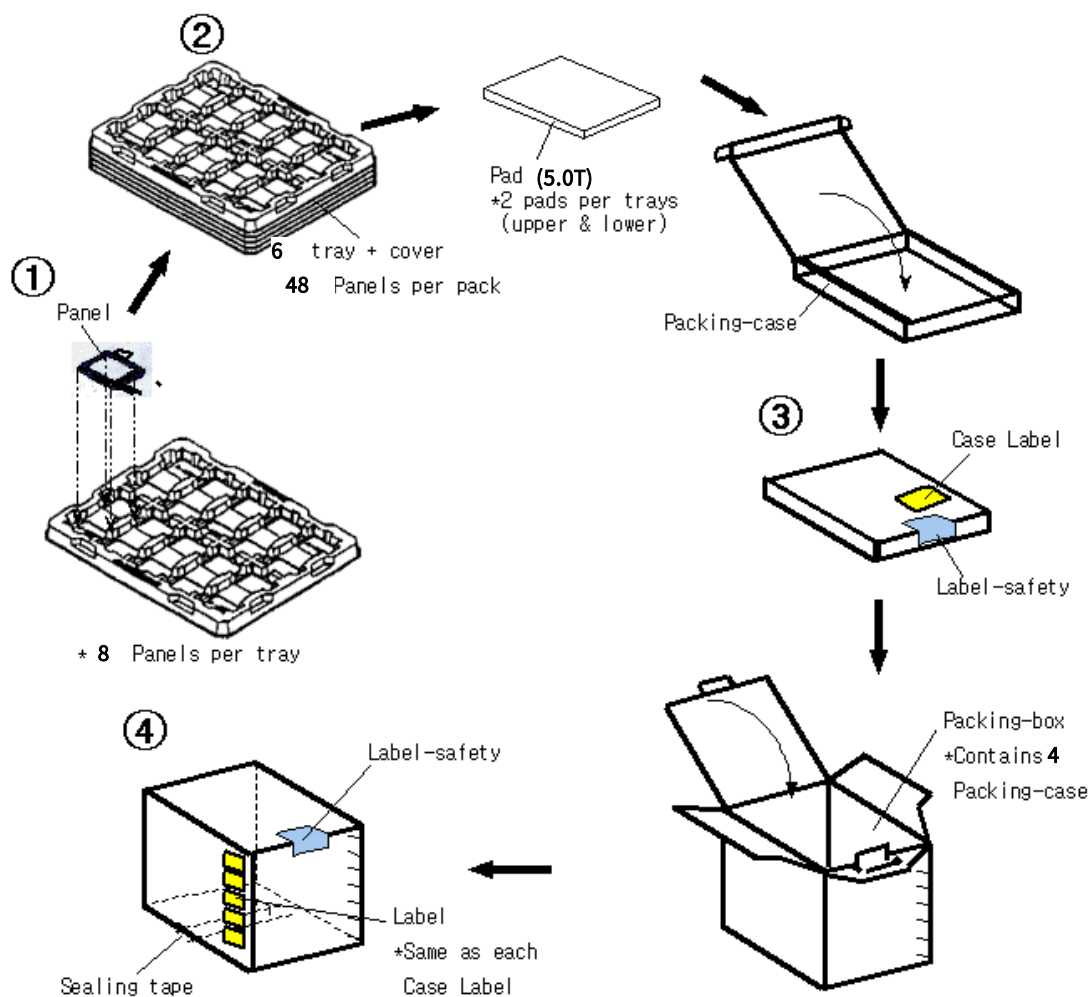
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14. Packing Specification



- Note
- (1) Total : Case: Approx. T.B.D
Box: Approx. T.B.D
 - (2) Size : Case: 384(W) x 278(D) x 16(H)x0.8T
Box: 406(W) x 288 (D)x 95 (H)
 - (3) Pad Material : Polyethylene Foam T=5.0
 - (4) Resistance of tray surface : $10^3 \sim 10^6 \Omega$
 - (5) ESD of tray surface : 20~100V
 - (6) Place the panels in the tray facing the direction shown in the figure.
 - (7) Place TBD tray and cover(empty tray) and pads inside the packing-case.
 - (8) Place 4 packing-case inside the packing-box.(Affix the label)
 - (8) Seal the packing-box. Affix the label-safety.