Specification for Approval

MODEL NO. : NMA35QV65-B2-K01

Customer: Chumby

Customer	Chumby Co., Ltd	
Prepared by	Checked by	Approved by

Supplier	Nanovision Co., Ltd	
Prepared by	Checked by	Approved by
		

Nanovision Co., Ltd

Revision History

Rev.	Date	Content	Modified by
Ver 0.0	2007/01/15	Approval Specification is first issued.	
Ver 0.1	2008/03/24	Serial Peripheral Interface is modified.	Page 14

Contents

1. Scope

This specification defines design and performance criteria for a color, transmissive mode, active matrix, liquid crystal display (LCD) Panel using amorphous silicon thin film transistor (TFT) technology.
The intended application for this module is for the display of text and graphic information and is suitable for use in Multimedia Player products produced for and sold by Nanovision.

This document defines the requirements for the design and qualification of the LCD Module described here in. It is not necessary that each parameter specified in this document be tested in a production environment. The test equipment and procedures described here in are for design verification and not meant to indicate what equipment will be used in the production facility.

* Applications

PMP(Personal Multimedia Player), DSC(Digital Still Camera), Digital Application Products.

2. General Features

- Transmissive type and back-light with six LEDS(Serial type).
- Support Resolution 320xRGBx240 (16.7M Color)
- Interface Method
  24bit parallel RGB Interface (8bit x 3).
- Internal Vcom circuit.
- Good Reliability. (Apply Metal Chassis)
- High Color Purity : 60%
- High Brightness: 250cd/㎡(typ).
- Ultra Low Power consumption.
- Touch Screen Panel(Analog Resistive type).
  Double Clear type. (A-Touch, A035-9D-N7I1S016)
- RoHS compliant.

* General Specifications

PARAMETER		SPECIFICATIONS	UNIT
DISPLAY MODE		Transmissive	-
DISPLAY SIZE(DIAGONAL)		3.5	Inch
DISPLAY OPERATION MODE		Normally White	
DRIVER ELEMENT		a-Si TFT active matrix	
ACTIVE AREA (H x V)		70.08 x 52.56	mm
PANEL OUTLINE DIMENSION (H x V)		75.10 x 61.90	mm
MODULE DIMENSION (H x V x T)		76.9 x 63.9 x 4.2	mm
NUMBER OF DOTS		320 x RGB x 240	dot
PIXEL PITCH (H x V)		0.219(0.073)x0.219	mm
PIXEL ARRANGEMENT		Stripe type	-
NUMBER OF COLORS		16.7M	Colors
COLOR PURITY		60	%
BRIGHTNESS		(250)	cd/㎡
DRIVER IC		HX8238	
VIEWING DIRECTION		6 o'clock	-
RESPONSE TIME (Tr + Tf)		50	ms
CONTRAST RATIO	TRANSMISSIVE	300:1	-
OPERATING TEMPARTURE		-20 ~ 60	℃
TOUCH SCREEN PANEL		Analog Resistive type	

3. Absolute Maximum Ratings

(Ta = 25 ±2℃, VSS = GND = 0)

Item	Symbol	Min.	Max.	Unit	Note
Power supply voltage	VDD	-0.3	5.0	V	(1),(2)
Operating Temperature	TOPR	-20	60	℃	(3),(4)
Storage Temperature	TSTG	-30	80	℃	(3)
BLU Current	IB		25	mA	

Note (1) All of voltage listed above are with respective to GND = VSS = 0V

(2) Device is subject to be damaged permanently if stresses beyond those absolute maximum rating listed above.

(3) 90% RH Max. (60℃) No condensation.

(4) In case of below 0°, the response time of liquid crystal (LC) becomes slower
And the color of panel becomes darker than normal one.
Level of retardation depends on temperature, because of LC's characteristics.

4. Electrical Characteristics

4.1 TFT-LCD Module

(Ta = 25 ±2℃, VSS = GND = 0)

Item		Symbol	Min.	Typ.	Max.	Unit	Note
Digital supply voltage		VDD	3.0	3.3	3.6		
Power Dissipation	Black	P_{Full}		23.1		mW	
	White			19.8			
Frame frequency		f_{FRAME}		60		Hz	
Dot Clock		DOTCLK			10	MHz	
Serial Clock		SCL			20	MHz	

* To prevent a latch-up or DC operation of the LCD module, the power on/off sequence should be As the Power On/Off Sequence.

4.2 Back-Light Unit

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Consumption	PBL	-	400		mW	(1)
Current	IB	-	20	-	mA	(2)

Note (1) Where IB = 20mA, VB = PBL/IB

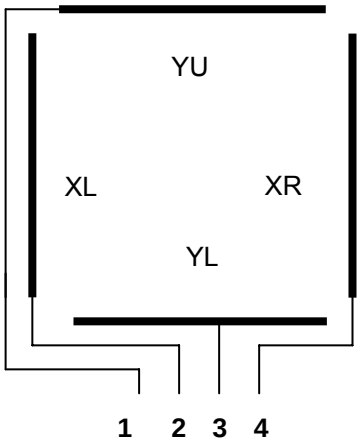
(2) 6 LEDs serial type.

(3) Permanent damage to the device may occur if maximum values are exceeded or reverse Voltage is loaded.
Functional operation should be restricted to the conditions described under normal operating conditions.

4.3 Touch Screen Panel

4.3.1 TSP Circuit Diagram & Signal Assignment

Circuit Diagram



Signal Assignment

Pin No.	Signal
1	YU
2	XL
3	YD
4	XR

4.3.2 Electrical Characteristics

Item	Min.	Typ.	Max.	Unit	Note
Linearity	-1.5	-	1.5	%	Analog X and Y directions
Terminal resistance	200	-	900	Ω	X1 ~ X2
	200	-	900	Ω	Y1 ~ Y2
Insulation resistance	20	-	-	MΩ	DC25V
Voltage	-	-	7	V	DC
Chattering	-	-	10	ms	100KΩ Pull-up
Transparency	-	83	-	%	JIS-K7105

Caution (1) : Do not operate it with a thing except a polyacetal(tip R0.8mm or more) or a finger, especially Those with hard or sharp tips such as a ball point pen or a mechanical pencil.

4.3.3 Mechanical & Reliability Characteristics

Item		Min.	Typ.	Max.	Unit	Note
Activation force	stylus	-	-	80	gf	(1)
	finger			80		
Durability (Writing friction)		Write 100,000	-	-	characters	(2)
Durability (Finger touches)		1,000,000	-	-	touches	(3)
Surface hardness		3	-	-	H	JIS K5400

Note (1) Stylus pen input : R0.8mm polyacetal pen or Finger

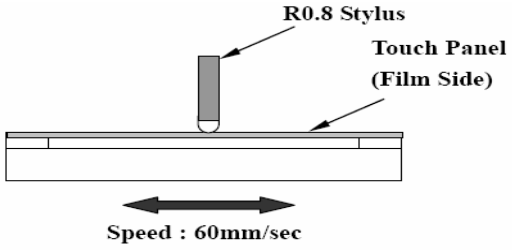
(2) Measurement for Surface area

- Write 100,000 capital or small alphabetical characters with a stylus in an area 20mm x 20mm
- Loads : 250gf
- Speed : 60mm/sec
- Pen : 0.8R polyacetal stylus
- Measurement position : Center of Touch Panel

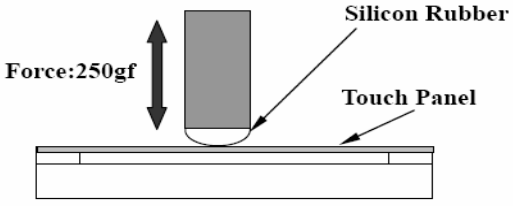
(3) Punching 1,00,000 times with a silicon rubber R8.0, hardness of 60°.

- Force : 250gf.
- Speed : 2times/sec

Writing friction



Finger touches

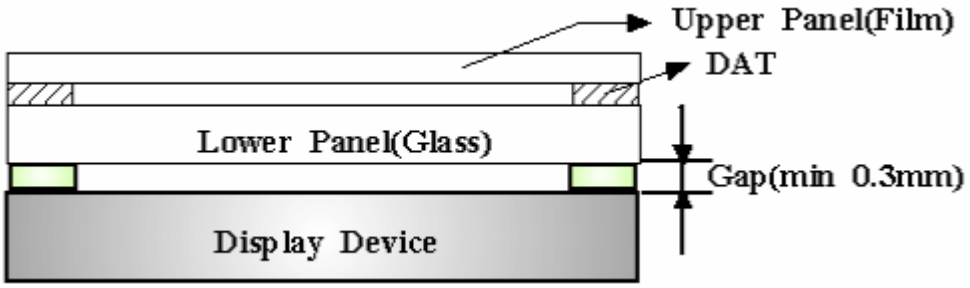


4.3.4 TSP Reliability

Item	condition	Remark
Operation temperature	-20℃ ~ +60℃	(No Condensation)
Operation humidity	Less than 90% RH	"
Storage temperature	-30℃ ~ +70℃	"
Storage humidity	Less than 90% RH	"

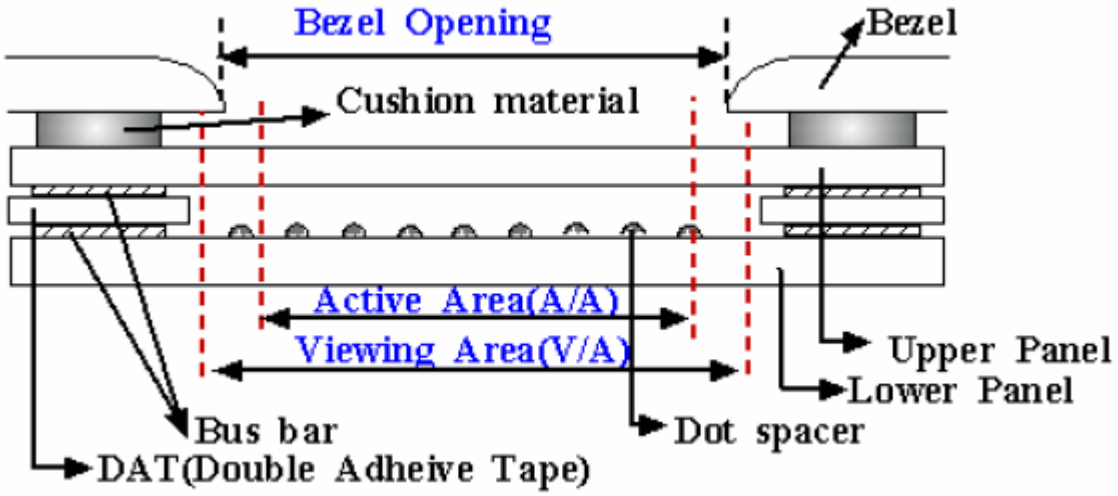
4.3.5 Housing design

- Keep the gap(over 0.3mm) between the touch panel and flat-panel display to protect a display device.



- Keep the gap(over 0.3mm) between the bezel edge and touch panel surface.
  The reason is to prevent the bezel from contacting touch panel surface which may cause a short with the bottom layer.

- We recommend the use of a cushion material between the touch panel and the bezel.



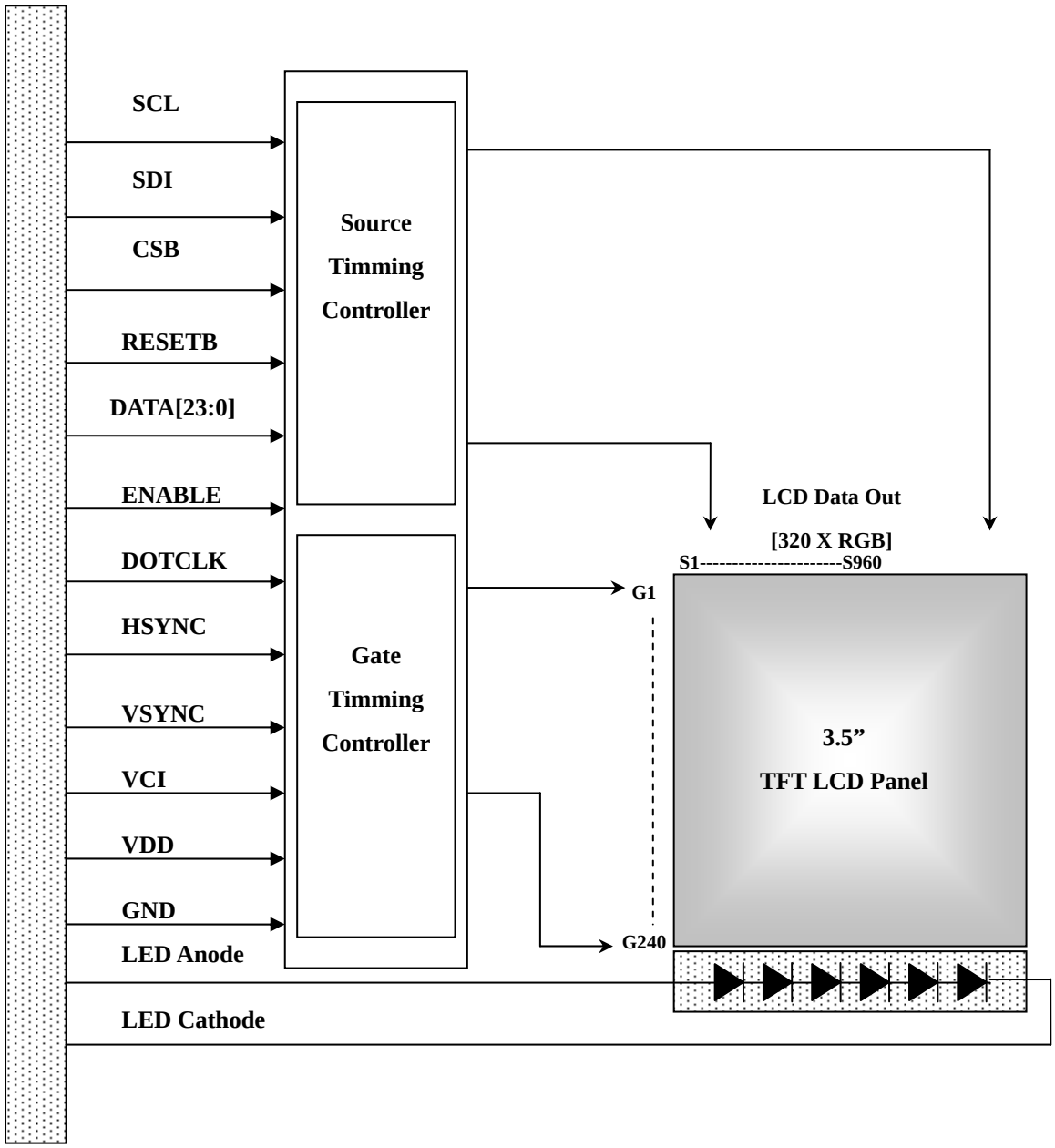
- The cushion material should be limited only on the busbar area.
  If it is out the busbar area, a short may occur.

4.3.6 Operation

- Please do not operate touch panels by applying excessive force.
- Please do not use a sharp things except finger or R0.8 polyacetal.
- We recommend calibration after long term use tip pen for input.

5. Block Diagram

5.1 TFT-LCD Module (Interface System Structure) with Back Light Unit



6. Input Pin Assignment

Pin	Symbol	Description
1~2	LED_K	LED Cathode(-)
3~4	LED-A	LED Anode(+)
5	GND	GND
6	X1	X_Right-(XR)
7	Y1	Y_Bottom-(YD)
8	X2	X_Left-(XL)
9	Y2	Y_Up(YU)
10	GND	GND
11~13	N.C	Non Connection
14	/RESET	Reset
15	SPENA	Serial data enable
16	SPCK	Serial clock
17	SPDA	Serial data
18	B0	Blue Data 0(LSB)
19~24	B1~B6	Data 1 ~ Data 6
25	B7	Blue Data 7(MSB)
26	G0	Green Data 0(LSB)
27~32	G1~G6	Data 1 ~ Data 6
33	G7	Green Data 7(MSB)
34	R0	Red Data 0(LSB)
35~40	R1~R6	Data 1 ~ Data 6
41	R7	Red Data 7(MSB)
42	HSYNC	Horizontal sync
43	VSYNC	Vertical sync
44	DCLK	Dot(data) Colck
45~46	N.C	Non Connection
47~48	VDD	Power Supply(3.3V)
49~57	N.C	Non Connection
58	DEN	Data Enable Signal
59~60	GND	GND

7. Operation Specifications

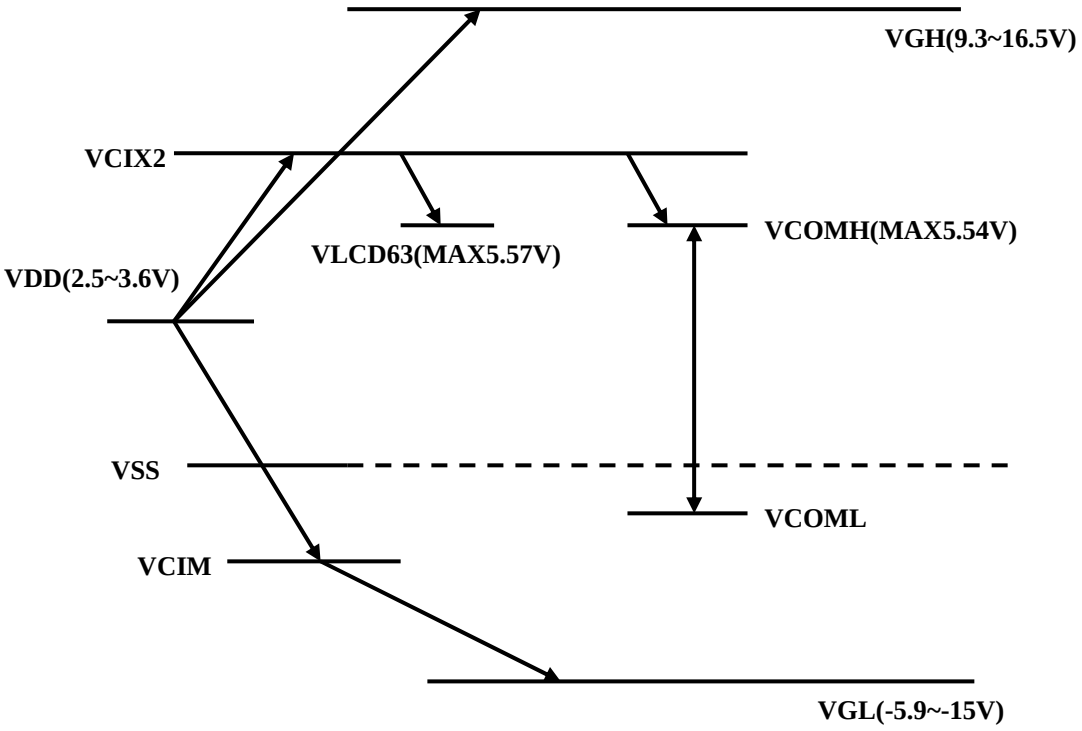
Please refer to HX8328-A datasheet for more details

7.1 Power on/off sequence

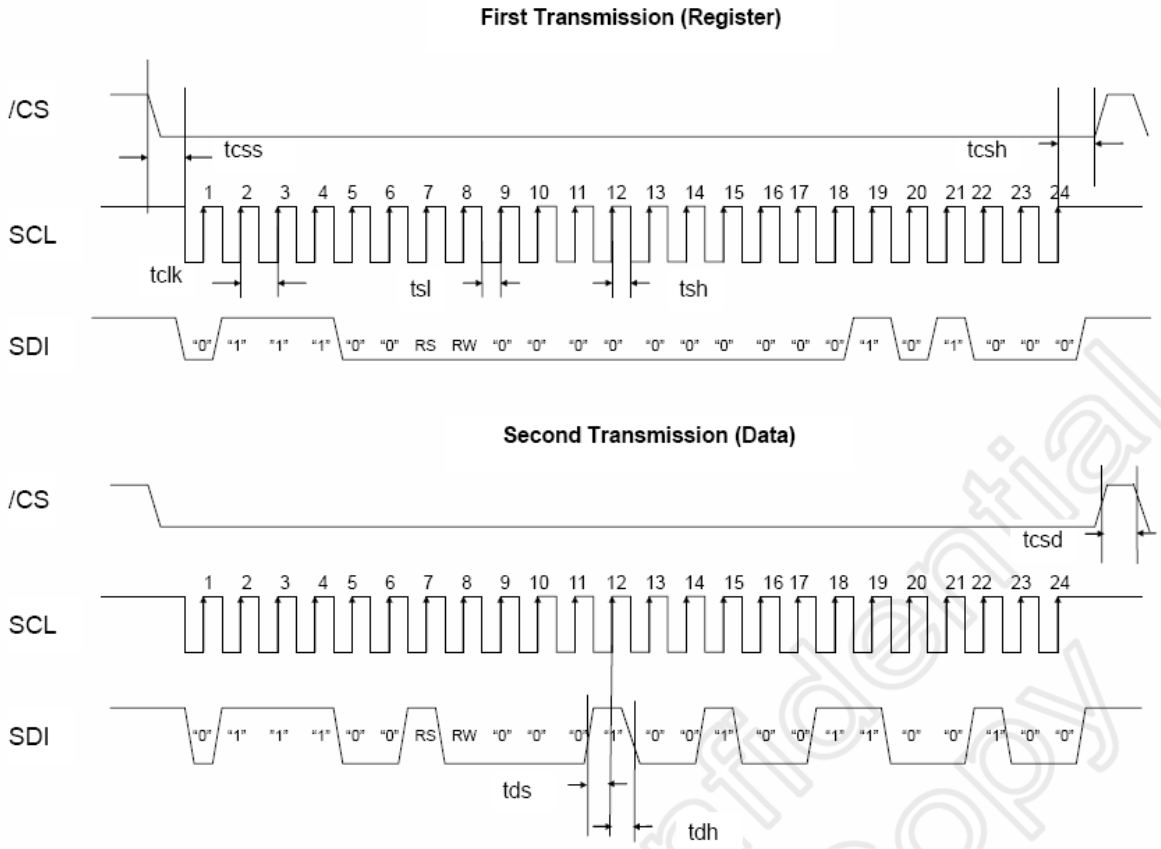
To prevent the device damage from latch up, the power on / off sequence shown below must be followed

Power On : VDD → VGL → VGH

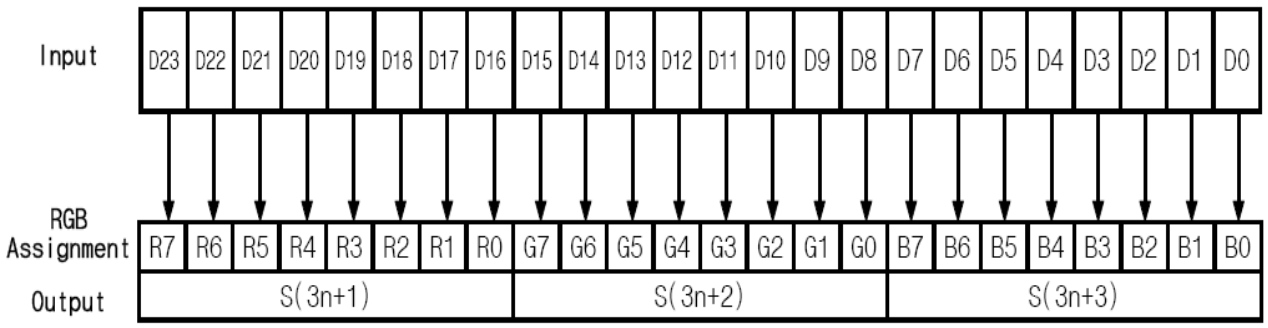
Power Off : VGH → VGL → VDD



7.2 Serial Peripheral Interface

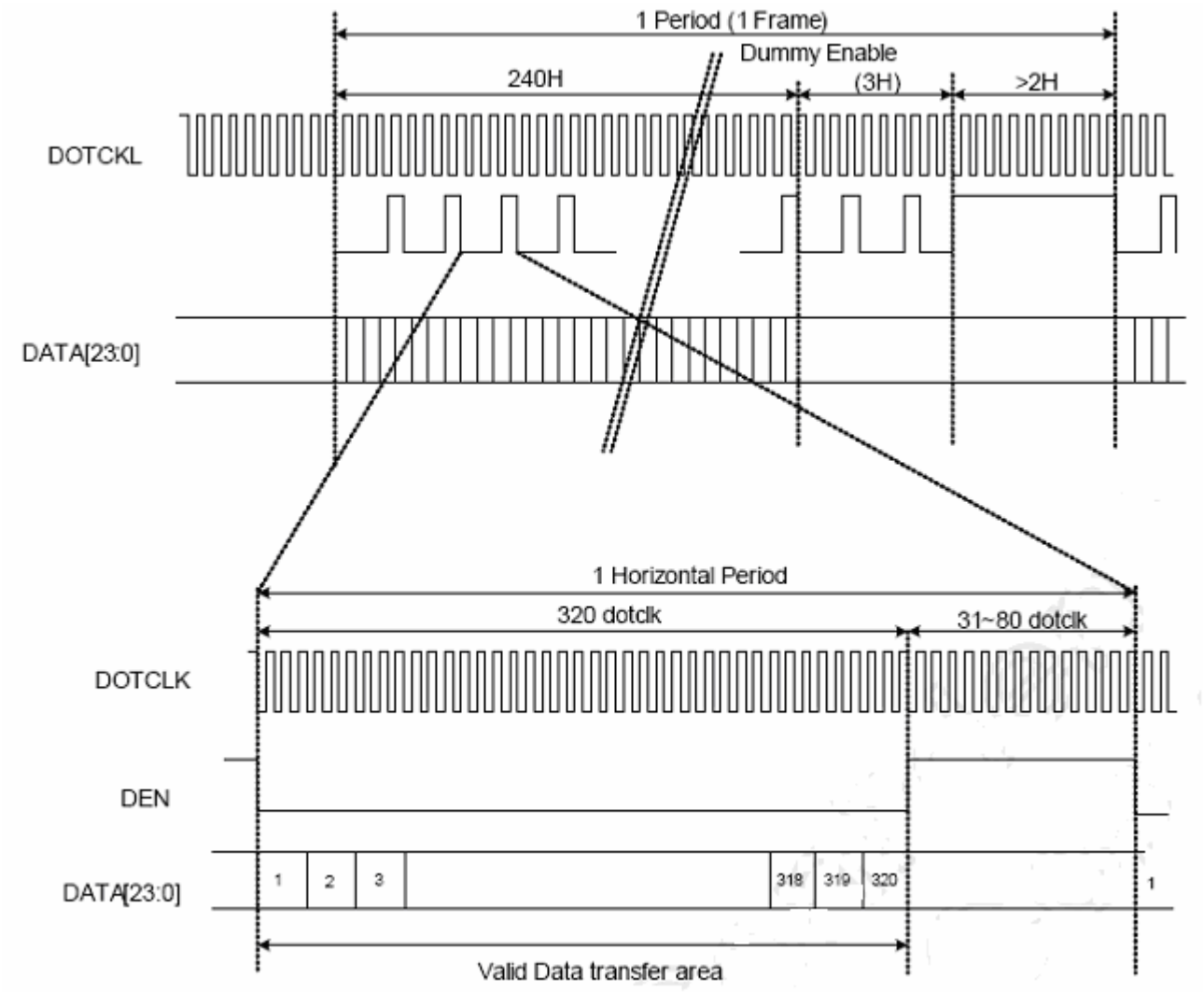


7.3 Data Format for 24bit RGB Interface



7.4 24bit RGB Interface Timing

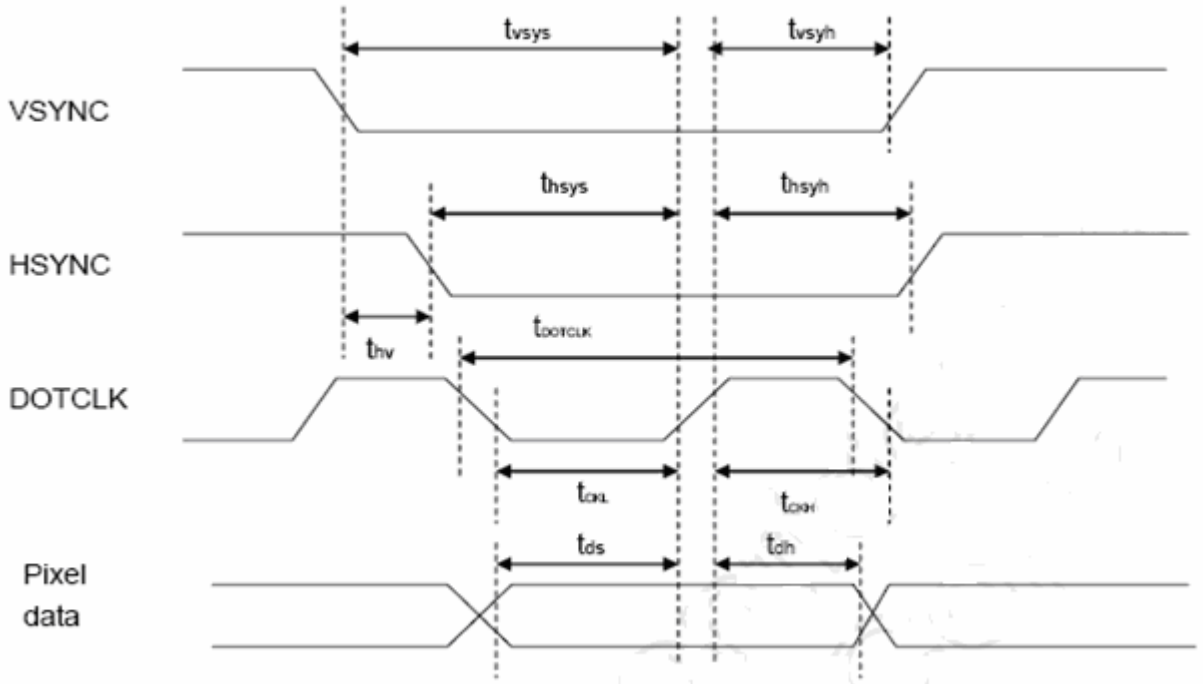
- Signal timing in DE mode



8. AC Characteristics

8.1 RGB Data Interface Characteristics

*** Refer to HX8238-A**



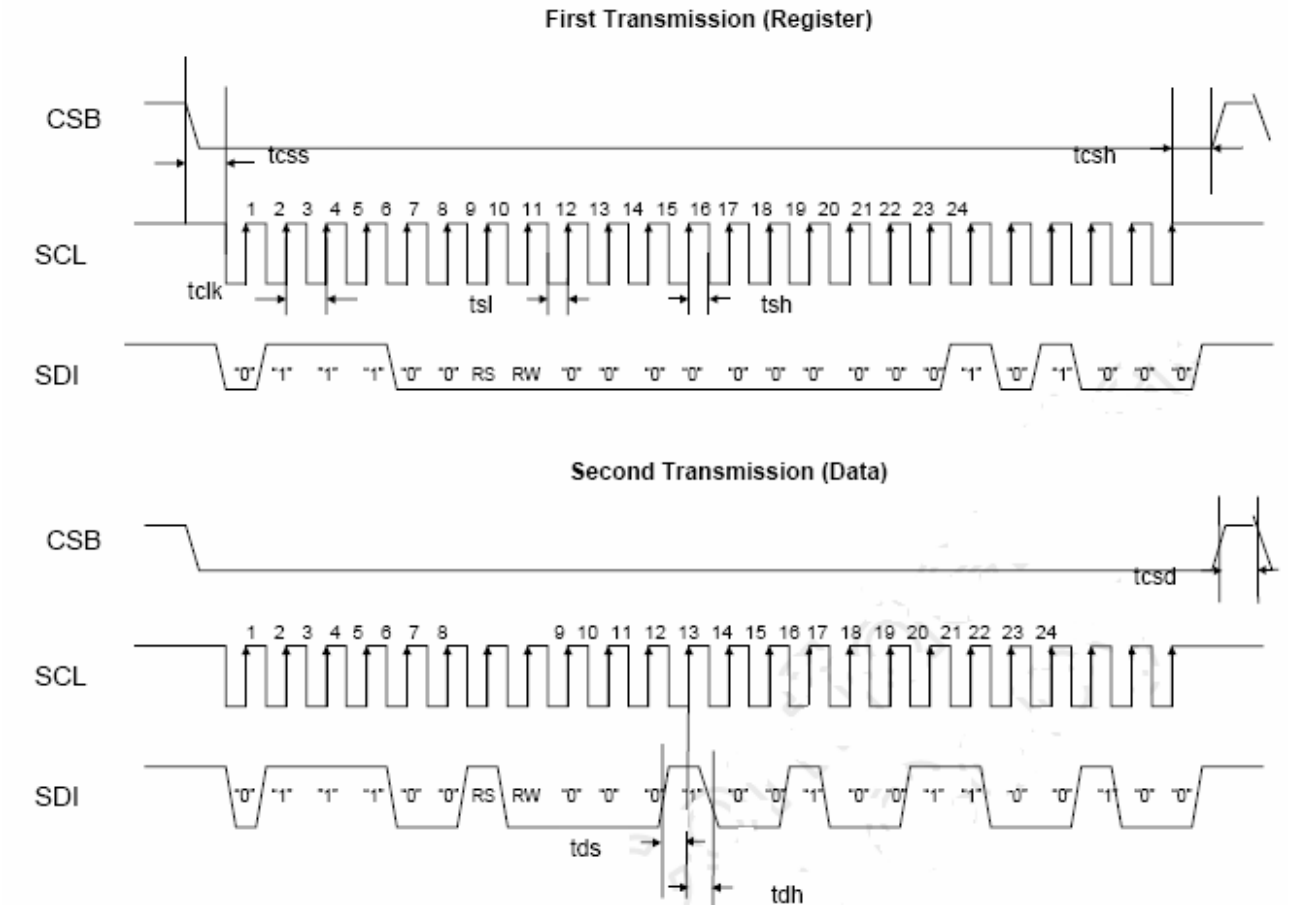
PARAMETER	Symbol	Min.	Typ.	Max.	Unit
DOTCLK Frequency	fDOTCLK	-	6.5	10	MHz
DOTCLK Period	tDOTCLK	100	154	-	ns
Vertical Sync Setup Time	tvsys	20	-	-	ns
Vertical Sync Hold Time	tvsyh	20	-	-	ns
Horizontal Sync Setup Time	thsys	20	-	-	ns
Horizontal Synnc Hold Time	thsyh	20	-	-	ns
Phase difference of Sync Signal Falling Edge	thv	1	-	240	tDOTCLK
DOTCLK Low Period	tCKL	50	-	-	ns
DOTCLK High Period	tCKH	50	-	-	ns
Data Setup Time	tds	12	-	-	ns
Data hold Time	tdh	12	-	-	ns
Reset pulse width	tRES	1	-	-	us

Note:

(1) External clock source must be provided to DOTCLK pin of HX8238-A. The driver will not operate if Absent of the clocking

8.2 Clock Synchronized Serial Mode Characteristics

*** Refer to HX8238-A**



PARAMETER	Symbol	Min.	Typ.	Max.	Unit
Serial Clock Frequency	fclk	-	-	20	MHz
Serial Clock Cycle Time	tclk	50	-	-	ns
Clock Low Width	tsl	25	-	-	ns
Clock High Width	tsh	25	-	-	ns
Chip Select Setup Time	tcss	0	-	-	ns
Chip Select Hold Time	tcsh	10	-	-	ns
Chip Select Hold Time	tcsd	20	-	-	ns
Chip Select High Delay Time	tds	5	-	-	ns
Data Hold Time	tdh	10	-	-	ns

9. Optical Specification

Measuring equipment:BM-5A, OPTI-SCOPE, EZ-Contrast

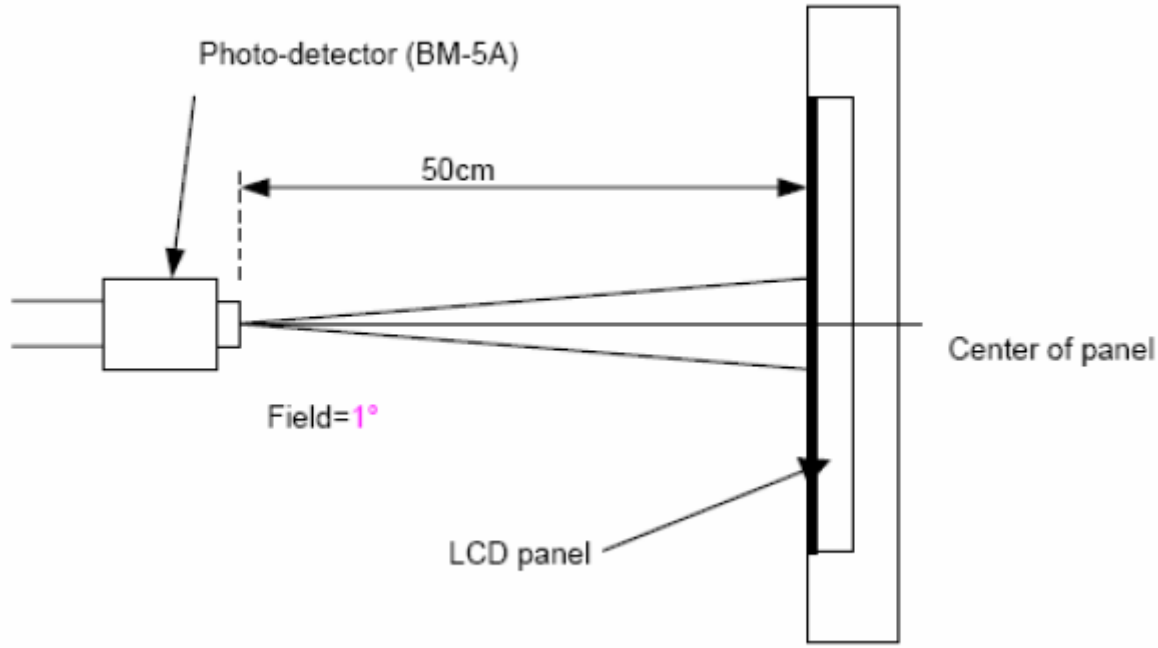
(Ta = X℃ ±2℃, AVDD = 4.9, VDD = 3.3V)

Item		Temp	Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast ratio (Center point)		25℃	C/R	Note (1)		(300)	-		(2)
Color gamut			-		-	(60)	-	%	
Luminance of white (Center point)			YL	θ = 0 Φ = 0	-	(250)	-	cd/㎡	
Response time			Tr + Tf	Normal Viewing Angle B/L On	-	(50)		msec	(3)
CIE Color chromaticity	White		Wx			(0.312)			(1)
			Wy			(0.349)			
	Red		Rx			(0.639)			
			Ry			(0.344)			
	Green		Gx			(0.294)			
			Gy			(0.587)			
	Blue		Bx			(0.132)			
			By			(0.349)			
Viewing angle	Hor.		θL	C/R≥10 B/L On		(60)		Degrees (4)	
			θR			(60)			
	Ver.		ΦL			(30)			
			ΦH			(50)			

Note (1) Test Equipment Setup

After stabilizing and leaving the panel alone at a given temperature for 30min, the measuring should be executed. Measuring be executed in a stable, windless, and dark room.

30 min after lighting the back-lghit. This should be measured in the center of screen.

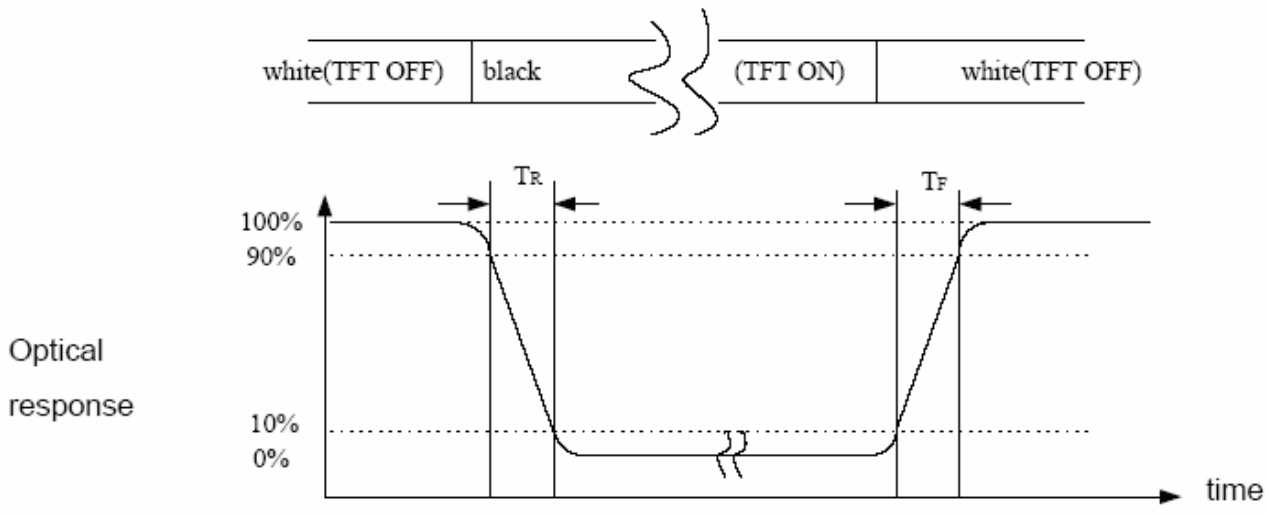


Note (2) Definition of Contrast Ratio (CR): Ratio of gray max(Gmax) & gray min(Gmin) at the center point

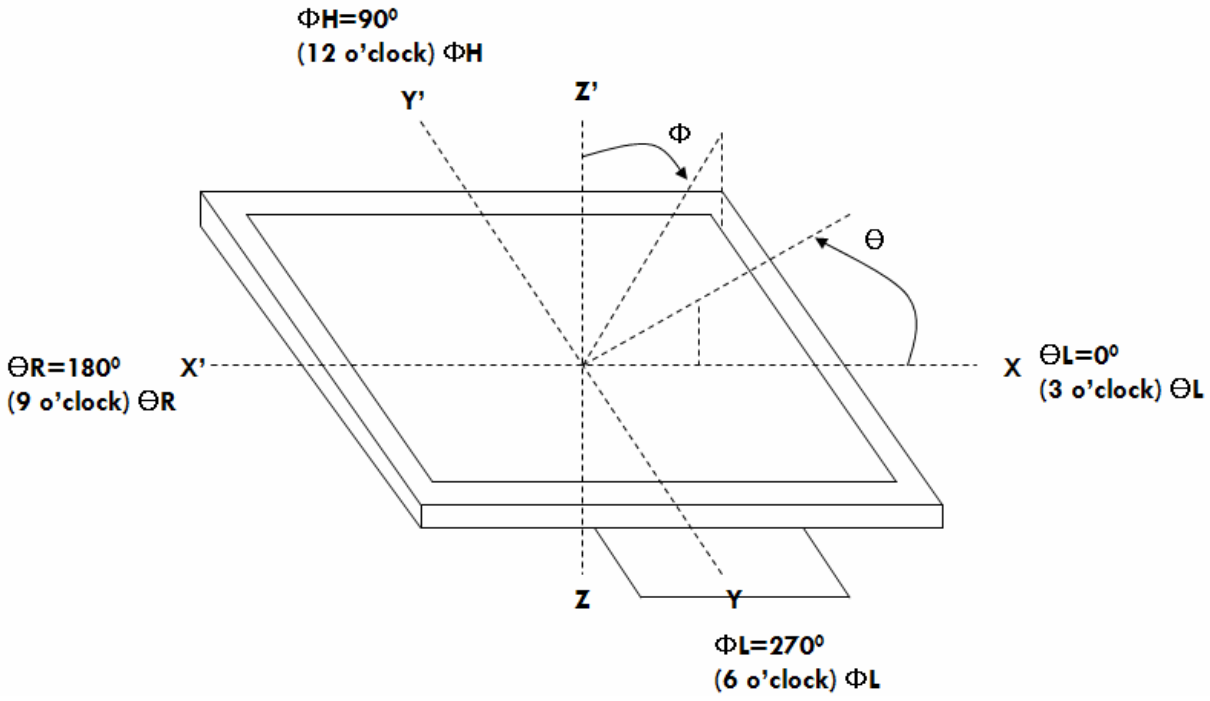
$$CR = \frac{Gmax}{Gmin}$$

* Gmax: Luminance with all pixels white
* Gmin: Luminance with all pixels black

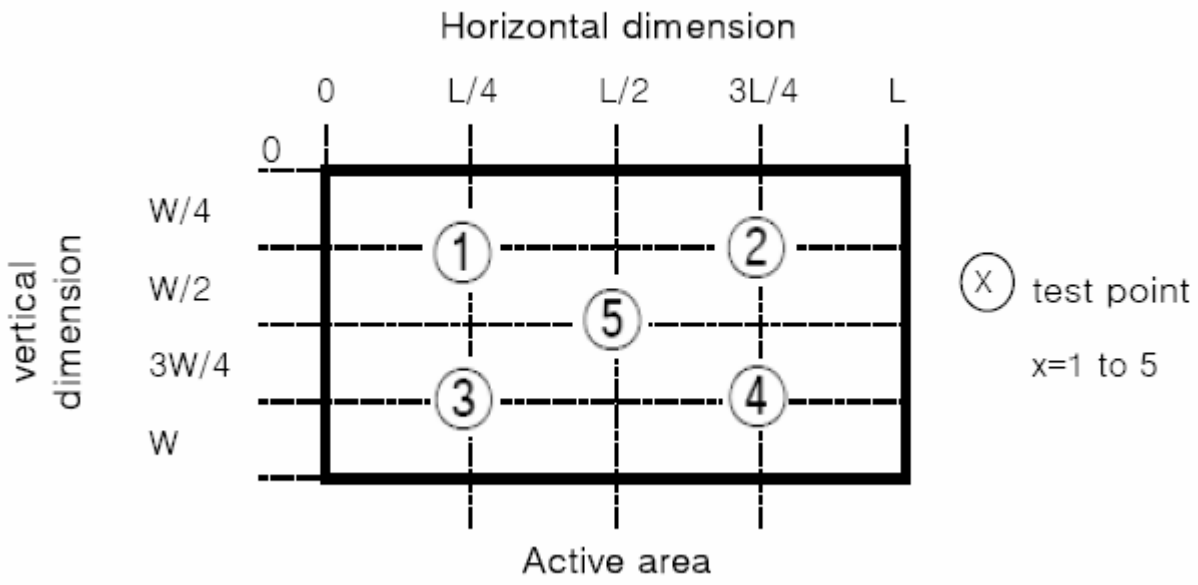
Note (3) Definition of Response time:



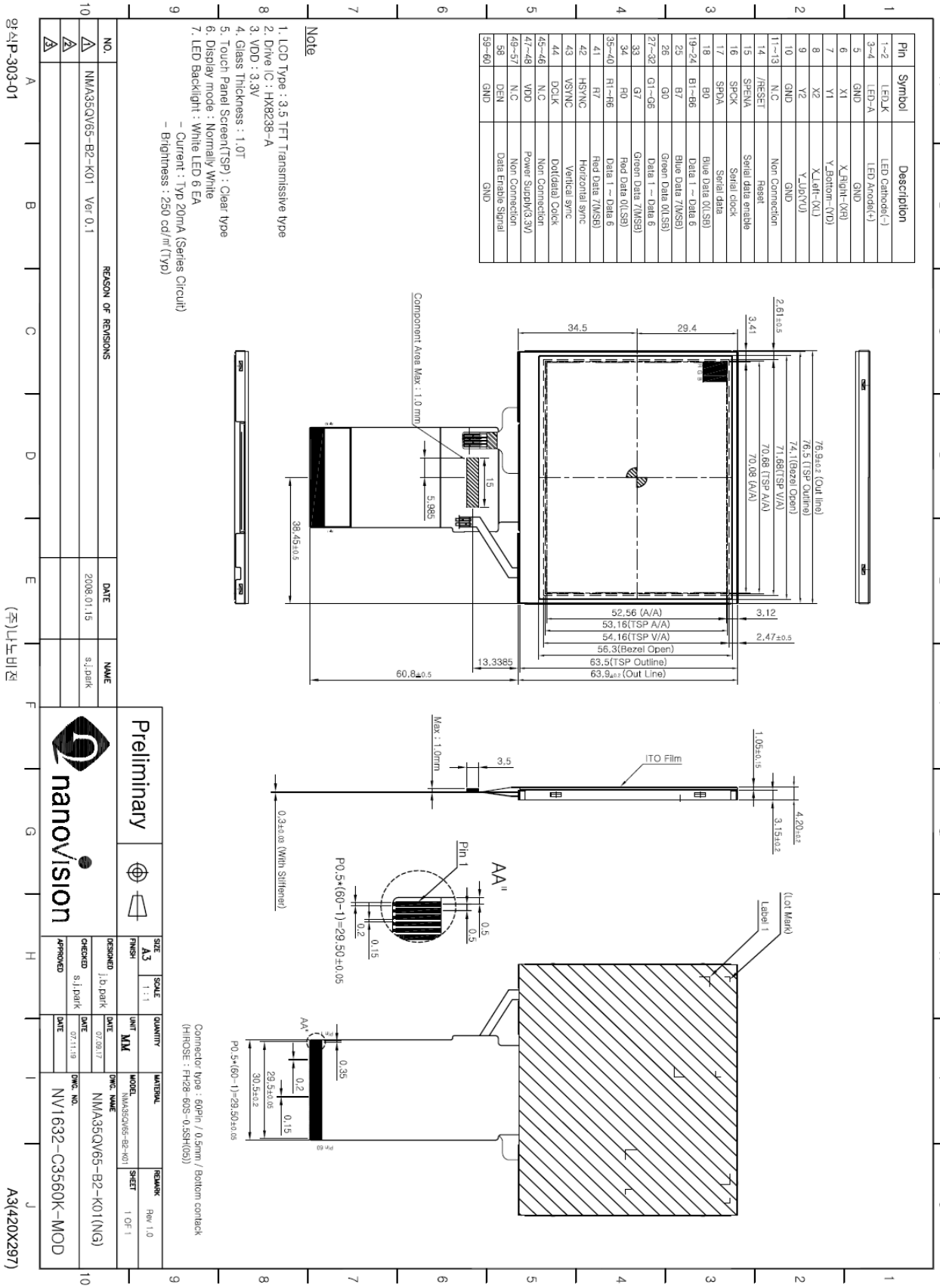
Note (4) Definition of viewing Angle: Viewing angle range (CR≥10)



Note (5) Measurement point



10. Outline Dimension



11. QUALITY SPECIFICATION FOR LCD MODULE

11.1 Objective

This specification book is the standard for LCD module general inspection. And also this book will be referring to customer approval specification.

11.2 Scope

This specification book is applicable to general LCD module. If supplier has any doubt or requirement, then it can be discussed.

11.3 Sampling Plan

Unless there is other agreement, sampling plan for incoming inspection should follow MIL-STD-105E.

1) Lot size : Quantity per shipment as one lot (different model as different lot.)
2) Sampling type : Normal inspection, single sampling.
3) Sampling level : Level Ⅱ.
4) AQL : Acceptable Quality Level

Major defect : AQL=0.65%

Minor defect : AQL=1.00%

11.4 Inspection condition

The environment condition for inspection shall be conducted as below.

11.4.1 Environment

Room Temperature: 25±5℃

Humidity: 50±20 % RH

Ambient Illumination: 500 ~ 700Lux for Visual inspection

Ambient Illumination: 200 ~ 300Lux for Display inspection

11.4.2 Inspection Distance: 35±5cm

11.4.3 Inspection Angle : The vision of inspector should be perpendicular to the surface of the module.

11.5 Classification of defects

Defects are classified as major defects and minor defects according to the degree of defectiveness defined herein.

11.5.1 Major defects:

A major defect is a defect that is likely to result in failure, or to reduce the usability of the product for its intended purpose

1) Abnormal display: modules cannot display normally.

2) Line defect

3) Non display

4) There is serious distortion

5) Glass Crack

11.5.2 Minor defects:

A minor defect is a defect that is not likely to reduce the usability of the product for its intended purpose.

1) Dot Defects

A. Inspection pattern: Full white, full black, red, green and blue screens.

B. Criteria (Acceptable)

Item	Total
Bright dot defect	N≤ 2
Two adjacent bright dots (Vertical, horizontal, oblique, see Note3)	N≤ 0
Dark dot defect	N≤ 3
Two adjacent dark dots (Vertical, horizontal, oblique, see Note3)	N≤ 0
Total	N≤ 4
Distance between dot and dot (vertical, horizontal, oblique, see Note3)	L≥5mm

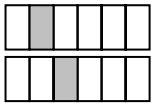
Note : 1.Dot defect is defined as the defective area of the dot is larger than 50% of the dot area. And the bright dot defect must be visible through 6% ND filter.

2. Except for the allowed numbers of adjacent dots, the distance between dot defects should be more than 5mm apart.

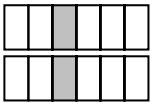
3. Two adjacent black dots is considered as one black dot, and bright/black dots is considered as one bright dot.

Horizontal adj.dots

Oblique adj.dots



Vertical adj.dots



2) Mura

It's OK if mura is not visible through 6% ND filter. (Judge by limit sample if it is necessary)

3) Extraneous substances

A. Criteria (Note:1,2,3,4,5)

Item			Acceptable criteria
Scratch on the polarizer L : Length (mm) W : Width (mm)		W ≤ 0.05, L ≤0.5	Ignore
		0.5 < L ≤2.5, 0.05< W≤0.1	N ≤ 2
		2.5 < L, 0.1 < W	None
Dent on the polarizer D : Average diameter (mm)		D ≤ 0.2	Ignore
		0.2< D ≤ 0.3	N ≤2
		0.3 < D	None
Bubble on the polarizer	Line shape L : Length(mm) W : Width (mm)	W ≤0.05, L ≤0.5	Ignore
		0.5 < L ≤2.5, 0.05 < W≤0.1	N≤2
		2.5 < L, 0.1 < W	None
	Dot Shape D : Average Diameter (mm)	D ≤ 0.2	Ignore
		0.20< D ≤ 0.30	N ≤ 2
		0.30 < D	None
Extraneous Substances	Spots D : Average Diameter (mm)	D ≤ 0.2	Ignore
		0.2 < D ≤ 0.25	N ≤ 3
		0.25< D ≤ 0.35	N ≤ 2
		0.35 < D	None
	Naps L : Length(mm) W : Width (mm)	W ≤0.05, L ≤0.5	Ignore
		0.5 < L ≤2.5, 0.05 < W≤0.1	N≤2
		2.5 < L, 0.1 < W	None

B. Criteria (TSP)

Defect Type	Criteria of Defect
Corner Chipping	X≤2.0mm and Y≤2.0mm and Z≤T, It is ignored.
Side Chipping	X≤3.0mm and Y≤2.0mm and Z≤T, It is ignored.
Progressive Crack	It is regarded as defective.

Note 1: Except for the ignored spot size, the distance between spot defects should be more than 5mm apart.

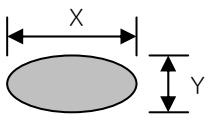
2: Polarizer bubble is defined as the bubble appears on active display area. The defect of polarizer bubbled shall be ignored if the polarizer bubble appears on the out side of the active display area.

3: The extraneous substance is defined as it can be observed when the module is power on.

4: Extraneous substance is defined as it can not be removed from the Module components.

5: The definition of D, average diameter is defined as follows.

D=(X+Y)/2, where



12. Reliability Test

After the tests as listed below have been performed, this module shall satisfy the criteria as listed under 12.3

12.1 Test condition

Test Item	Test Condition
High Temperature Operation	70±2℃, 120 hours
High Temperature Storage	80±2℃, 120 hours
Low Temperature Operation	-20±2℃, 120 hours
Low Temperature Storage	-30±2℃, 120 hours
High Temperature and High Humidity Operation	60℃, 90%(RH), 120 hours
Thermal Shock Test	-30℃(0.5h)↔80℃(0.5h), 50cycle
Vibration Test (Packaging State)	10~200Hz, 1.5G XYZ direction for 1.5 hour

12.2 Test method

12.2.1 Only a single item of these tests shall be executed on a single module.
A number of test items shall not be executed on a single module.

12.2.2 The test shall be executed under a condition where no dew condensation is formed.

12.2.3 After the test, the module should be left at normal temperature and humidity for 2 hours.
Then the module should be inspected for normal operation.

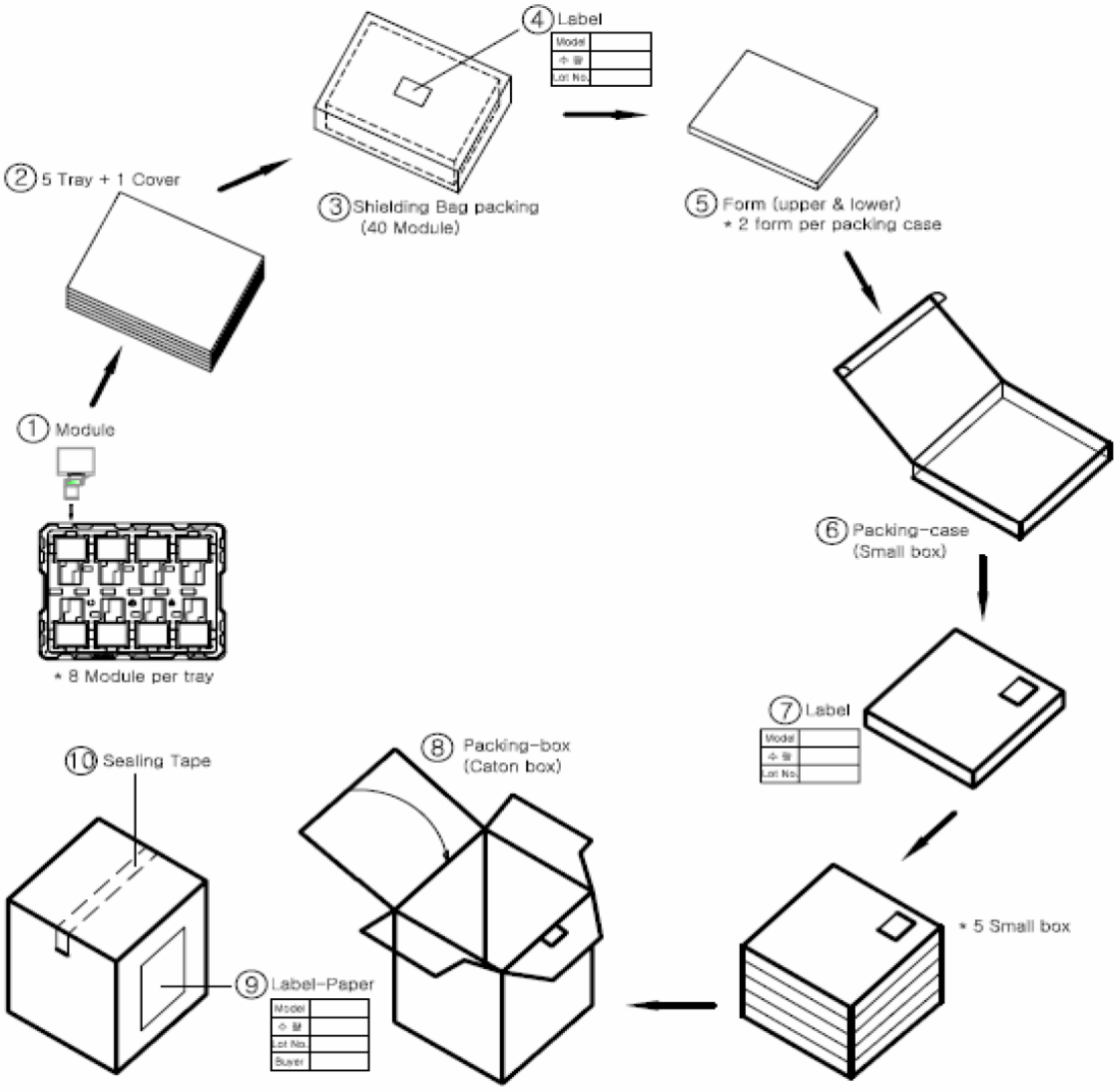
12.2.4 The conditions for operation tests shall be the same as those specified conditions for inspection.

12.3 Criteria for Reliability Test

12.3.1 There shall be no abnormality in the functions and the display.

12.3.2 Appearance and display quality should not have distinguished degradation.

13. Packing Form



No.	Q'TY	Parts	Size
1	8	Module	76.9±0.2 X 63.9±0.2 X 4.2 mm
2	6	Tray	421X342X11 mm
3	1	Shielding Bag	480X600 mm
4	2	Label-1	Art Paper 99.1X38.1 mm
5	2	Form	430X335X10 mm (Up. Down)
6	5	Inner Box	455X360X80 mm
7	1	Carton Box	470X375X445 mm
8	1	Label-2	Art Paper 200X140 mm
9	2m(L)	Tape	50mmX50mmX0.04mm
10	1	Final 1 Box (Inner box X 5) = 200 pcs	

14. Precautions

Operation Precautions

(1) Do not connect, disconnect the module in the “Power On” condition.
(2) Power supply should always be turned on/off by the chapter 8 TFT-LCD IC Operation Algorithms.

Storage Precautions

(1) Storage them in a dark place. Do not expose to sunlight or fluorescent light.
Keep the temperature between 5℃ and 35℃ at normal humidity.
(2) The TFT-LCD glass 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.

Handling Precautions

(1) Be sure insert and take out of the FPC into the connector of the set after turning off the power supply on the set side.
(2) On mounting the module, be sure to fix the module on the same place. Taking care not to warp or twist the module.
(3) The FPC for LCD panel shall be bent only slit portion. Don’t give the FPCs too large force, for example, hanging the module with holding FPC.
(4) Wipe off water droplets or oil immediately. If you leave the droplets for a long time, Staining and discoloration may occur.
(5) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.
(6) The desirable cleaners are water, IPA(Isopropyl Alcohol) or Hexane.
Do not use Ketone type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride.
It might permanent damage to the polarizer due to chemical reaction.
(7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth.
In case of contact with hands, legs or cloths, it must be washed away thoroughly with soap.
(8) Protect the module from static, it may cause damage to the CMOS Gate Array IC.
(9) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
(10) Do not disassemble the module.
(11) Protection film for polarizer on the module shall be slowly peeled off just before use so that the ectrostatic charge can be minimized.
(12) Pins of I/F connector shall not be touched directly with bare hands.

Others

(1) The Liquid crystal is deteriorated by ultraviolet, do not leave it in direct sunlight and strong ultraviolet ray for many hours.

(2) Avoid condensation of water. It may result in improper operation or disconnection of electrode.

(3) Do not exceed the absolute maximum rating value.
(The supply voltage variation, Input voltage variation, variation in part contents and environmental temperature,etc)
Otherwise the panel may be damaged.

(4) If the panel displays the same pattern continuously for a long period of time, it can be the situation when the image “Sticks” to the screen.

(5) This panel has its circuitry FPC on the bottom side and should be handled carefully in order not to be stressed.