SPECIFICATION
FOR
LCM Module
KD035QVFMA064

MODULE:	KD035QVFMA064
CUSTOMER:	

STARTEK	INITIAL	DATE
PREPARED BY		
CHECKED BY		
APPROVED BY		

CUSTOMER	INITIAL	DATE
APPROVED BY		

Revision History

Date	Rev. No.	Page	Summary
2017.05.18	V1.0	ALL	FIRST ISSUE
2017.05.26	V1.1	8	Update
2017.06.06	V1.2	6	Update Outline dimension
2017.06.30	V1.3	4	Modify Operating temperature
2019.04.09	V1.4	ALL	Update

Contents

* Description

This is a color active matrix TFT (Thin Film Transistor) LCD (liquid crystal display) that uses amorphous silico n TFT as a switching device. This model is composed of a Transmissive type TFT-LCD Panel, driver circuit, back-light unit. The resolution of a 3.5'TFT-LCD contains 240x320 pixels, and can display up to 65K/262K colors.

* Features

-Low Input Voltage: 3.3V(TYP)

-Display Colors of TFT LCD: 65K/262K colors

-Interface: 8/16/18Bit MCU Interface

3 SPI+16/18Bit RGB Interface

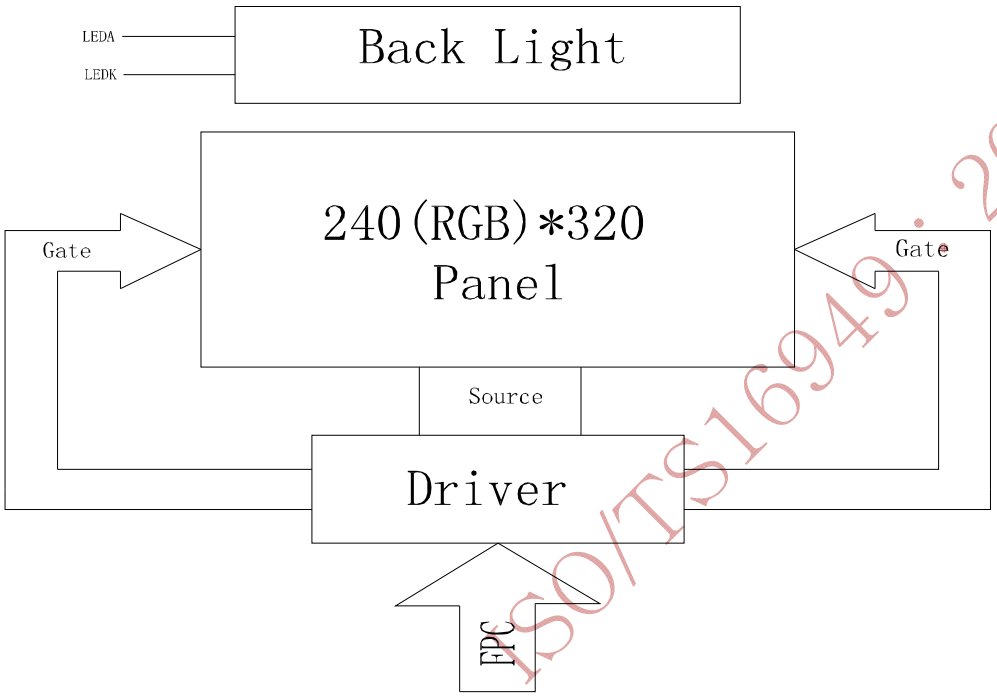
3 line Serial Interface

General Information Items	Specification	Unit	Note
	Main Panel		
Display area(AA)	53.28(H)*71.04（V） (3.5inch)	mm	-
Driver element	TFT active matrix	-	-
Display colors	65K/262K	colors	-
Number of pixels	240(RGB)*320	dots	-
Pixel arrangement	RGB vertical stripe	-	-
Pixel pitch	0.222(H)*0.222(V)	mm	-
Viewing angle	Free	o'clock	-
Controller IC	HX8347A	-	-
Display mode	Transmissive/ Normally Black	-	-
Operating temperature	-30～+85	℃	-
Storage temperature	-40～+90	℃	-

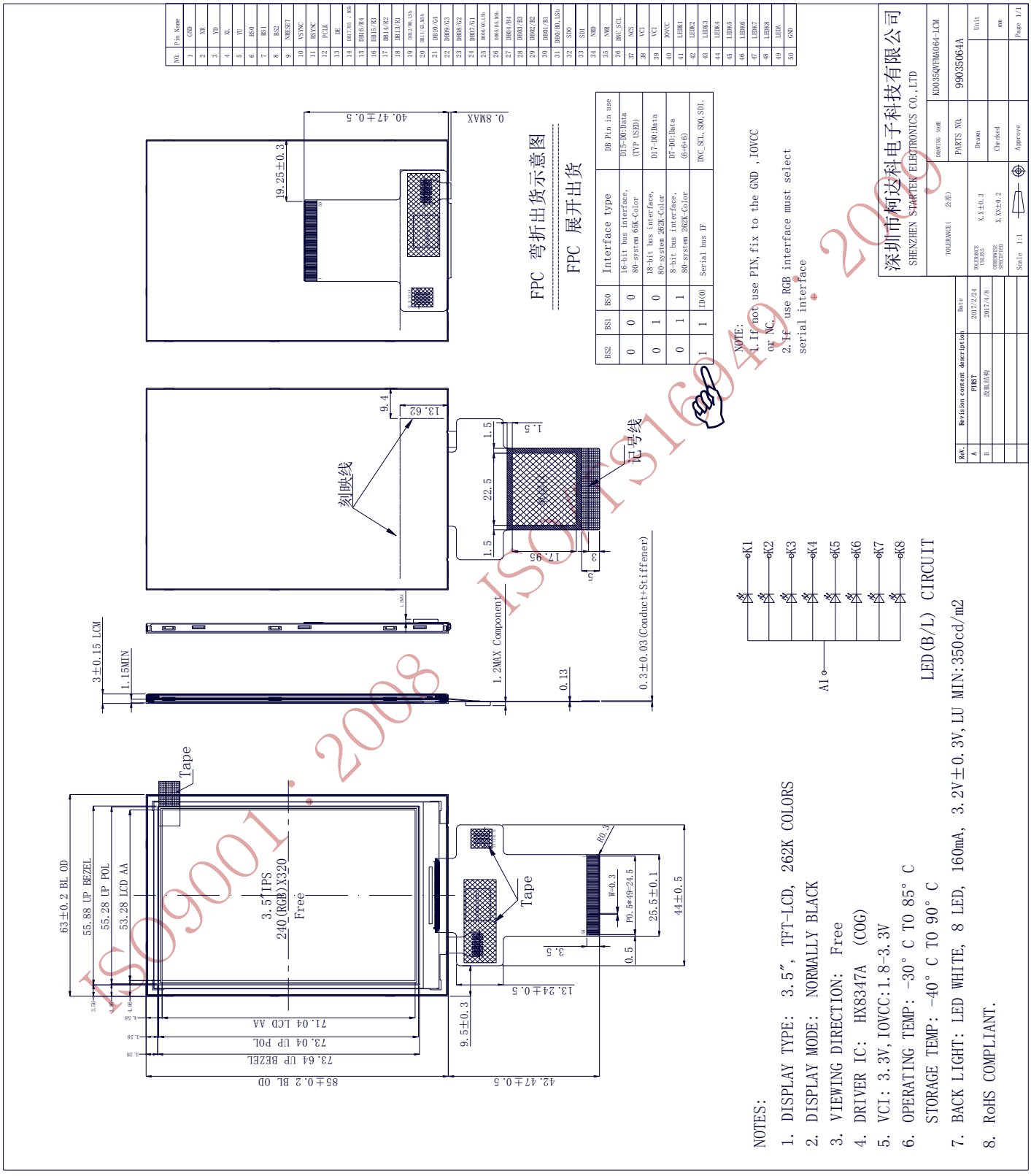
* Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal(H)		63.0		mm	-
	Vertical(V)		85.0		mm	-
	Depth(D)		3.0		mm	-
Weight			TBD		g	-

1. Block Diagram



2. Outline dimension



3. Input terminal Pin Assignment

NO.	SYMBOL	DISCRIPTION	I/O
1	GND	Ground.	P
2	XR (NC)	Touch panel Right Glass Terminal	A/D
3	YD(NC)	Touch panel Bottom Film Terminal	A/D
4	XL(NC)	Touch panel Left Glass Terminal	A/D
5	YU(NC)	Touch panel Top Film Terminal	A/D
6	BS0	MPU Parallel interface bus and serial interface select If use RGB Interface must select serial interface. Fix this pin at VCI and GND.	I
7	BS1		I
8	BS2		I
9	NRESET	This signal will reset the device and must be applied to properly initialize the chip.	I
10	VSYNC	Frame synchronizing signal for RGB interface operation. fix this pin at VCI or GND when not in use.	I
11	HSYNC	Line synchronizing signal for RGB interface operation. fix this pin at VCI or GND when not in use	I
12	PCLK	Dot clock signal for RGB interface operation Fix this pin at VCI or GND when not in use.	I
13	DE	Data enable signal for RGB interface operation. fix this pin at VCI or GND when not in use.	I
14-31	DB17-DB0	18-bit parallel bi-directional data bus for MCU system and RGB interface mode . Fix to GND level when not in use	I
32	SDO	Serial data output pin in serial bus system interface. If not used, please open this pin.	O
33	SDI	Serial input signal.The data is applied on the rising edge of the SCL signal. If not used, fix this pin at VCI or GND.	I
34	NRD	Serves as a read signal and MCU read data at the rising edge. fix this pin at VCI or GND when not in use.	I
35	NWR	NWR pin, serves as a write signal	I
36	DNC_SCL	DNC_SCL pin as Serial Clock when operates in the serial interface	I

37	NCS	Chip select input pin (“Low” enable). fix this pin at VCI or GND when not in use.	I
38	VCI	Supply voltage(3.3V).	P
39	VCI	Supply voltage(3.3V).	P
40	IOVCC	Supply voltage(1.8-3.3V)	P
41	LEDK1	Cathode pin OF backlight	P
42	LEDK2	Cathode pin OF backlight	P
43	LEDK3	Cathode pin OF backlight	P
44	LEDK4	Cathode pin OF backlight	P
45	LEDK5	Cathode pin OF backlight	P
46	LEDK6	Cathode pin OF backlight	P
47	LEDK7	Cathode pin OF backlight	P
48	LEDK8	Cathode pin OF backlight	P
49	LEDA	Anode pin of backlight	P
50	GND	Ground.	P

4. LCD Optical Characteristics

4.1 Optical specification

Item		Symbol	Condition	Min.	Typ.	Max.	Unit.	Note
Contrast Ratio		CR	Θ=0 Normal viewing angle	--	800	--		
Response time	Rising	T_R		--	16	21	msec	
	Falling	T_F		--	19	24		
Color gamut		S(%)		--	72	--	%	
Color Filter Chromacicity	White	W_X		0.336	0.340	0.344		
		W_Y		0.356	0.360	0.364		
	Red	R_X		0.618	0.620	0.622		
		R_Y		0.338	0.340	0.342		
	Green	G_X		0.348	0.350	0.352		
		G_Y		0.620	0.622	0.624		
	Blue	B_X		0.148	0.150	0.152		
		B_Y		0.033	0.035	0.037		
Viewing angle	Hor.	Θ_L	CR>10	--	80	--		
		Θ_R		--	80	--		
	Ver.	Θ_U		--	80	--		
		Θ_D		--	80	--		
Option View Direction		Free						

4.2 Measuring Condition

- Measuring surrounding：dark room
- Ambient temperature：25±2℃
- 15min. warm-up time.

4.3 Measuring Equipment

Note 1: Ambient temperature = 25°C.

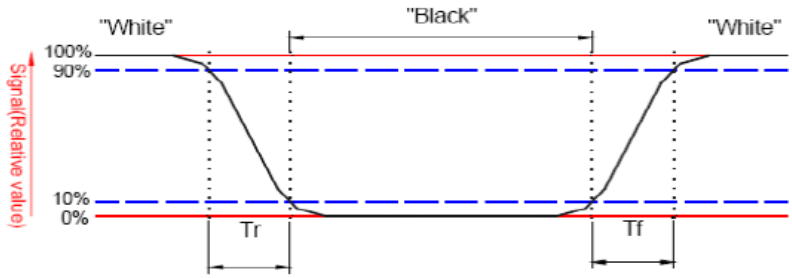
Note 2: To be measured with a viewing cone of 2°by Topcon luminance meter BM-5A.

Note 3: To be measured with Otsuta chromaticity meter LCF-2100M, CF only measure under C light simulation.

Note 4: CTC shipping status is cell without polarizer. Transmittance of Specification is cell with polarizer. The tolerance of Transmittance is ±10%.

Note 5: Definition of response time:

The output signals of TRD-100 are measured when the input signals are changed to "White" (falling time) and from "White" to "Black" (rising time), respectively. The interval is between the 10% and 90% of amplitudes. Refer to figure as below.

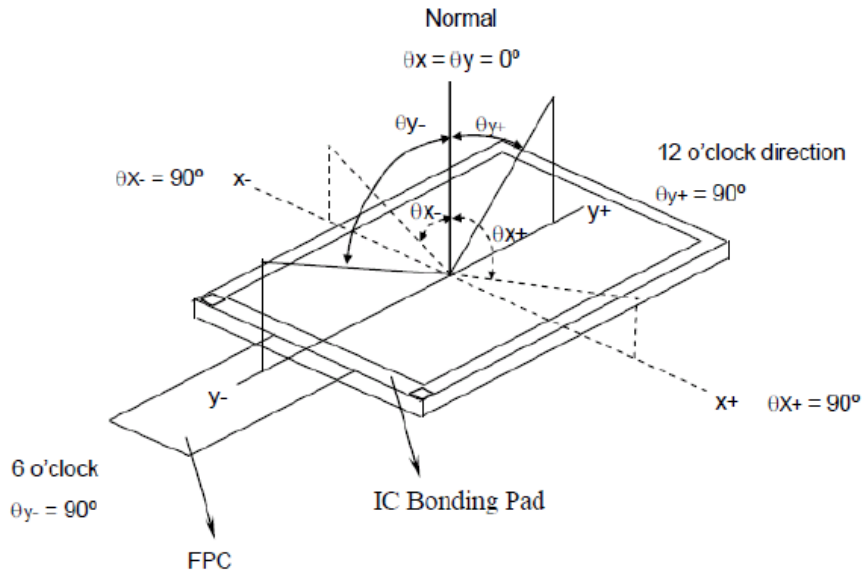


Note 6: Definition of contrast ratio:

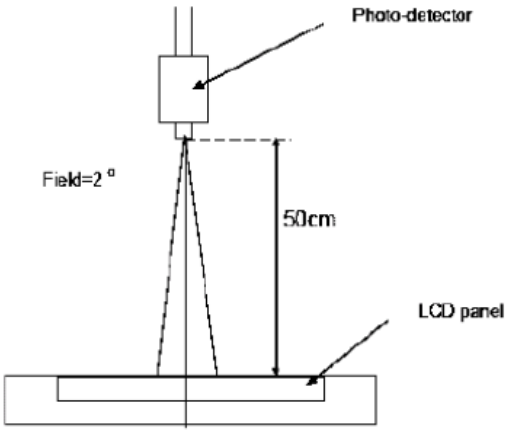
Contrast ratio is calculated by the following formula.

$$\text{Contrast ratio (CR)} = \frac{\text{Brightness on the "white" state}}{\text{Brightness on the "black" state}}$$

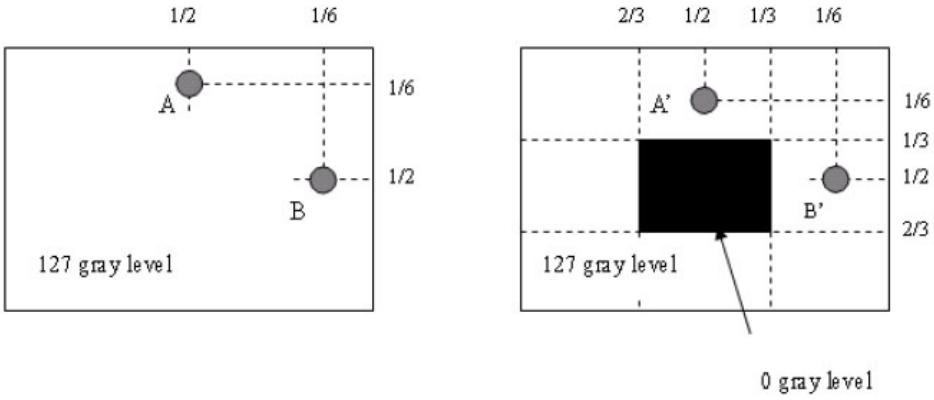
Note 7: Definition of viewing angle



Note 8: Optical characteristic measurement setup.



Note 9:



| LA-LA' | / LA x 100%= 2% max., LA and LA' are brightness at location A and A'.
| LB-LB' | / LB x 100%= 2% max., LB and LB' are brightness at location B and B'.

5. Electrical Characteristics

5.1 Absolute Maximum Rating (Ta=25 VSS=0V)

Characteristics	Symbol	Min.	Max.	Unit
Digital Supply Voltage	VCI	-0.3	4.2	**V**
Digital interface supple Voltage	IOVCC	-0.3	3.3	**V**
Operating temperature	T_{OP}	-30	+85	℃
Storage temperature	T_{ST}	-40	+90	℃

NOTE:
If the absolute maximum rating of even is one of the above parameters is exceeded even momentarily, the quality of the product may be degraded. Absolute maximum ratings, therefore, specify the values exceeding which the product may be physically damaged. Be sure to use the product within the range of the absolute maximum ratings.

5.2 DC Electrical Characteristics

Characteristics	Symbol	Min.	Typ.	Max.	Unit	Note
Digital Supply Voltage	VCI	2.5	2.8	3.3	V	
Digital interface supple Voltage	IOVCC	1.65	1.8	3.3	V	
Normal mode Current consumption	IDD	--	9	--	mA	
Level input voltage	V_{IH}	0.7IOVCC		IOVCC	V	
	V_{IL}	GND		0.3IOVCC	V	
Level output voltage	V_{OH}	0.8IOVCC		IOVCC	V	
	V_{OL}	GND		0.2IOVCC	V	

5.3 LED Backlight Characteristics

The back-light system is edge-lighting type with 8chips White LED

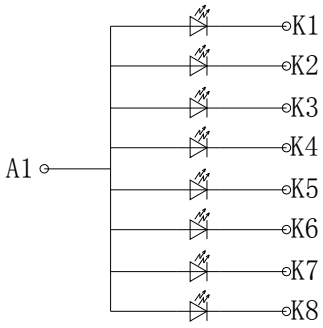
Item	Symbol	Min.	Typ.	Max.	Unit	Note
Forward Current	I_F	120	160	--	mA	
Forward Voltage	V_F	--	3.2	--	V	
LCM Luminance	L_V	400	450	--	cd/m2	Note3
LED life time	Hr	50000	--	--	Hour	Note1,2
Uniformity	AVg	80	--	--	%	Note3

Note (1) :

LED life time (Hr) can be defined as the time in which it continues to operate under the condition:

Ta=25±3 ℃, typical IL value indicated in the above table until the brightness becomes less than 50%.

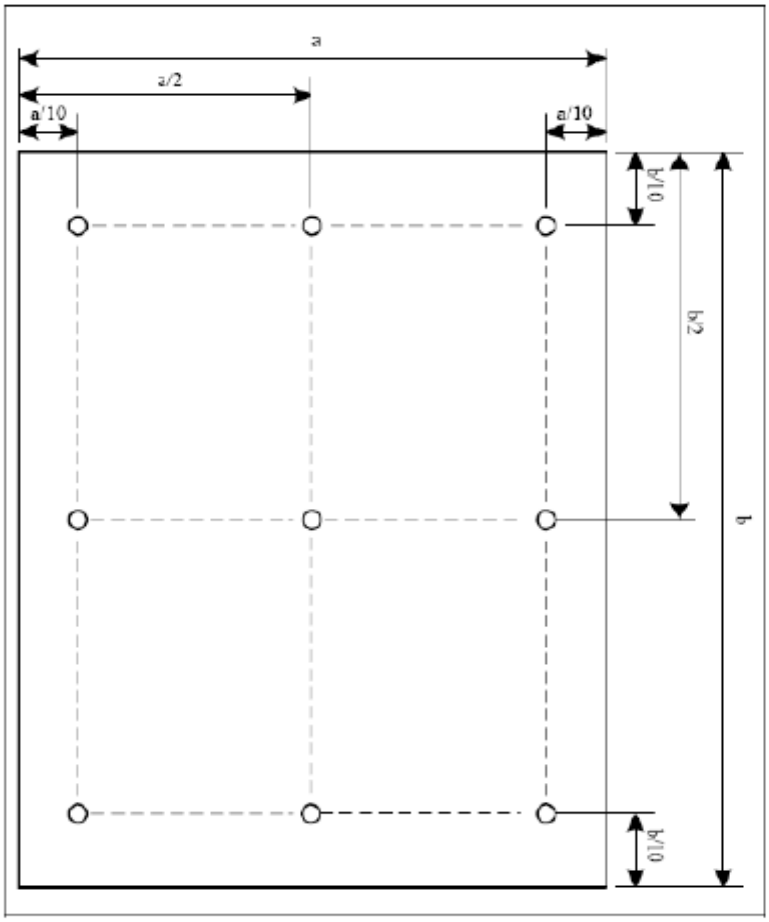
Note (2) The “LED life time” is defined as the module brightness decrease to 50% original brightness at Ta=25℃ and IL=160mA. The LED lifetime could be decreased if operating IL is larger than 160mA. The constant current driving method is suggested.



LED(B/L) CIRCUIT

LED WHITE, 8 LED, 160mA, 3.2V±0.3V

NOTE 3：Luminance Uniformity of these 9 points is defined as below:

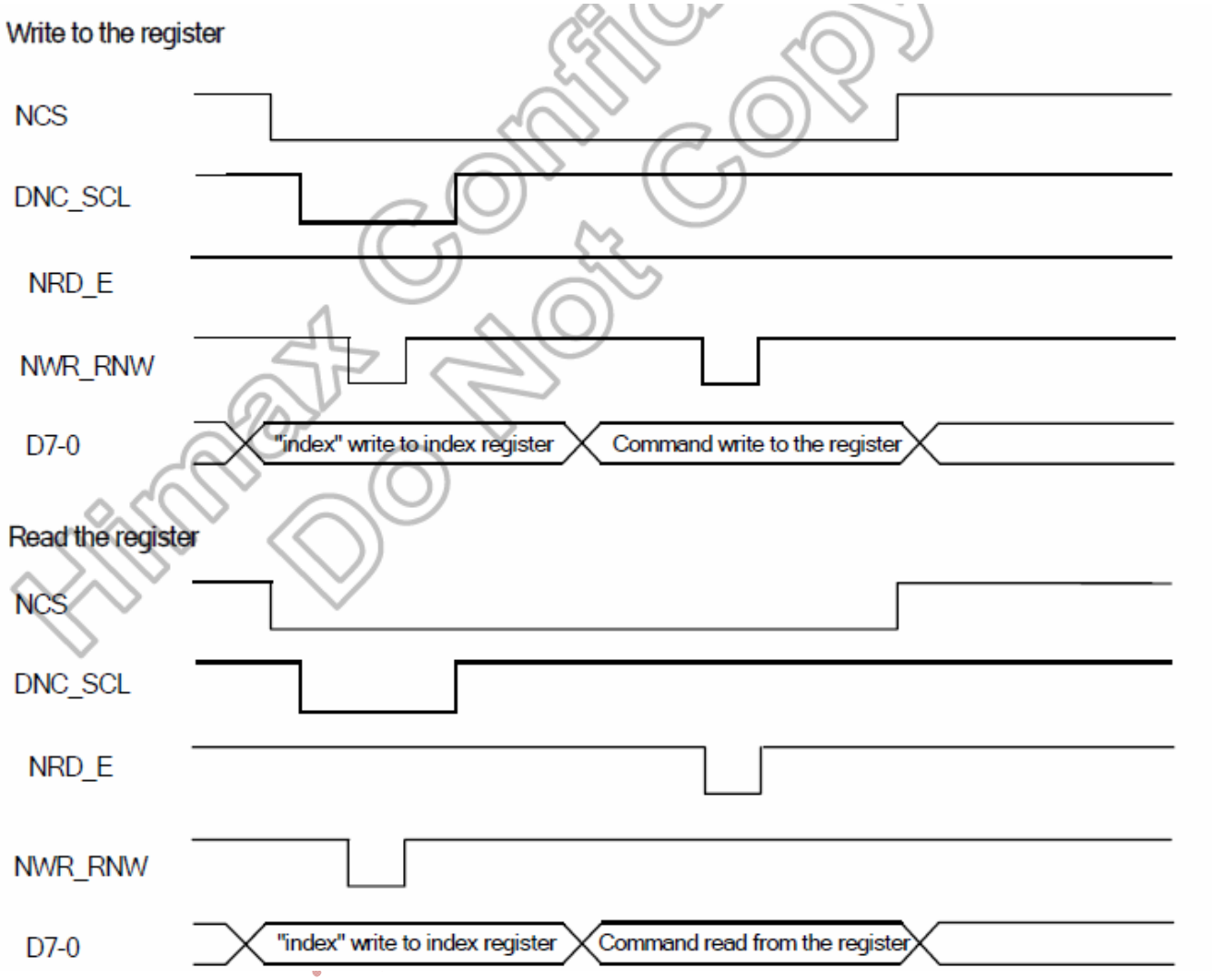


$$\text{Uniformity} = \frac{\text{minimum luminance in 9 points (1-9)}}{\text{maximum luminance in 9 points (1-9)}}$$

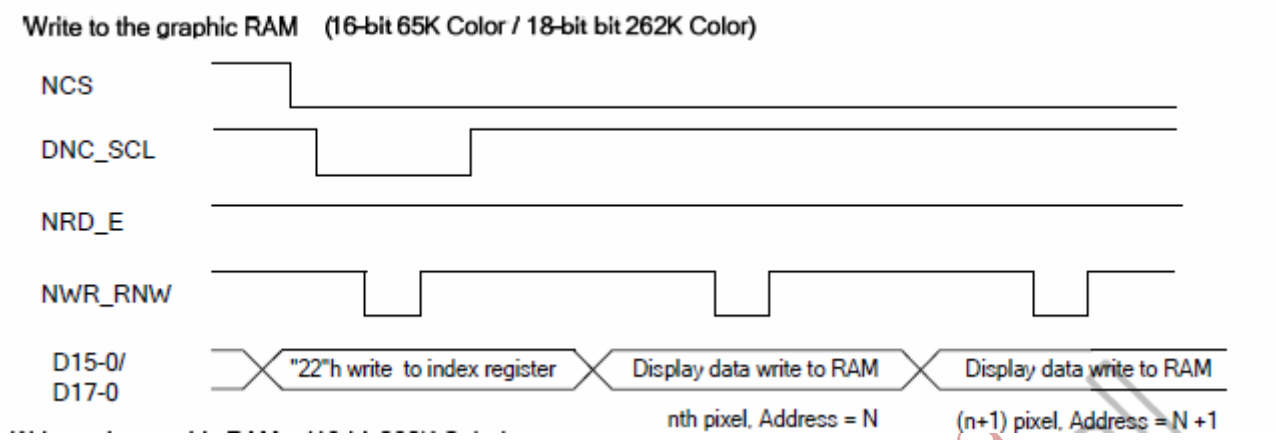
$$\text{Luminance} = \frac{\text{Total Luminance of 9 points}}{9}$$

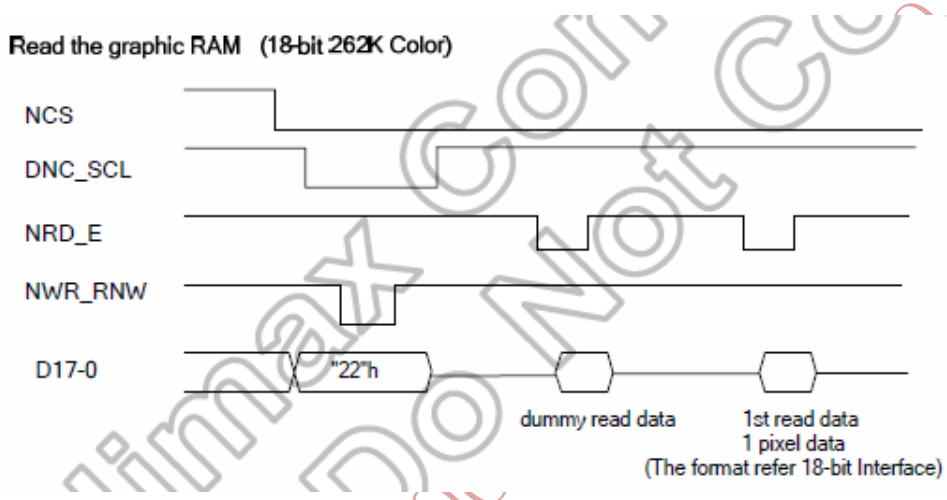
6. AC Characteristic

6.1 Display Parallel 8-bit Interface Timing Characteristics (8080 system)



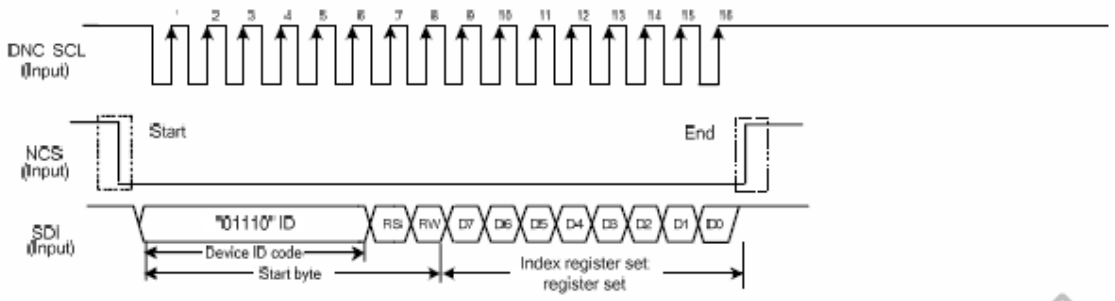
6.2 Display Parallel 16/18-bit Interface Timing Characteristics (8080 system)



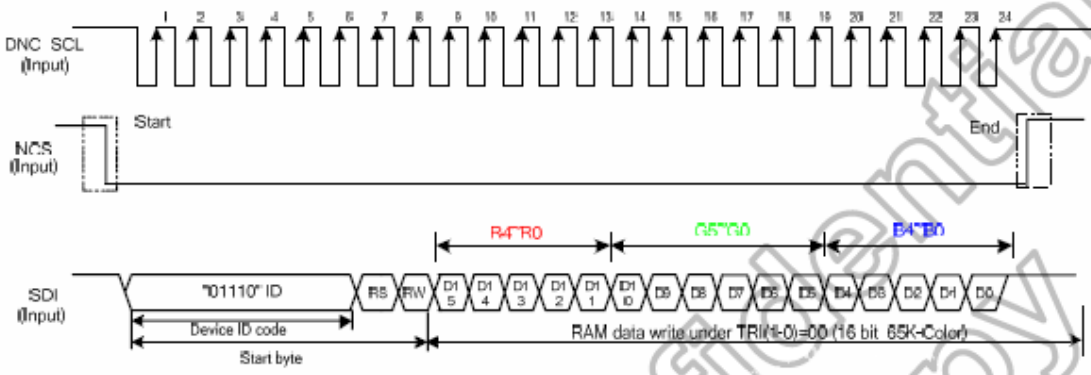


6.3 Display Serial Interface Timing Characteristics (3-line SPI system)

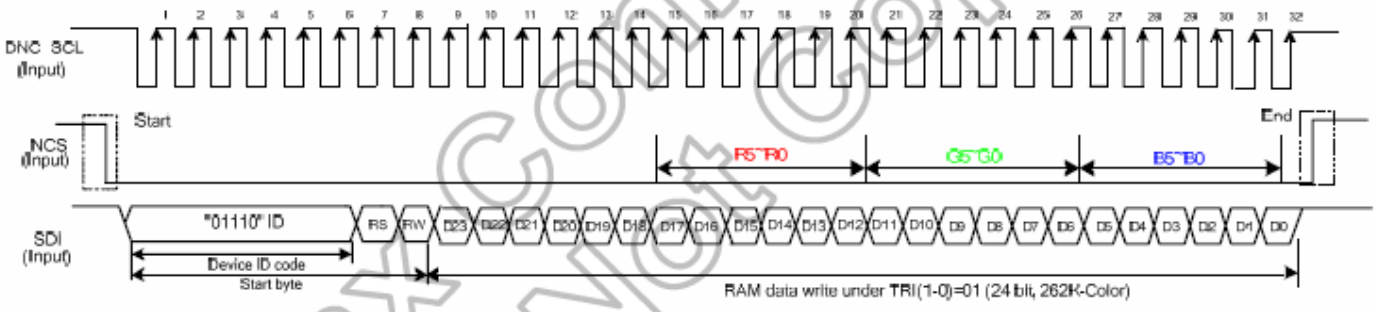
A)TransferTiming Format in Serial Bus Interface for Index Register or Register Wirte



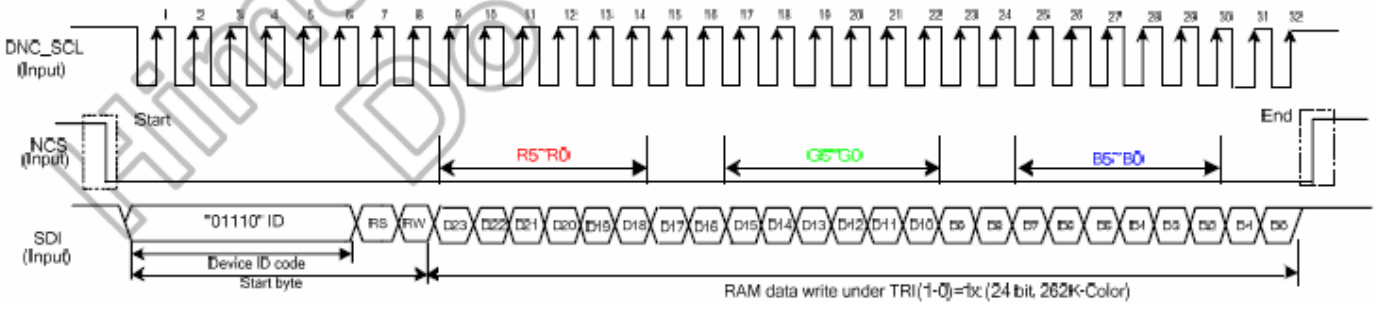
B) TransferTiming Format in Serial Bus Interface for GRAM write (index = "22h") , TRI(1-0) = 00



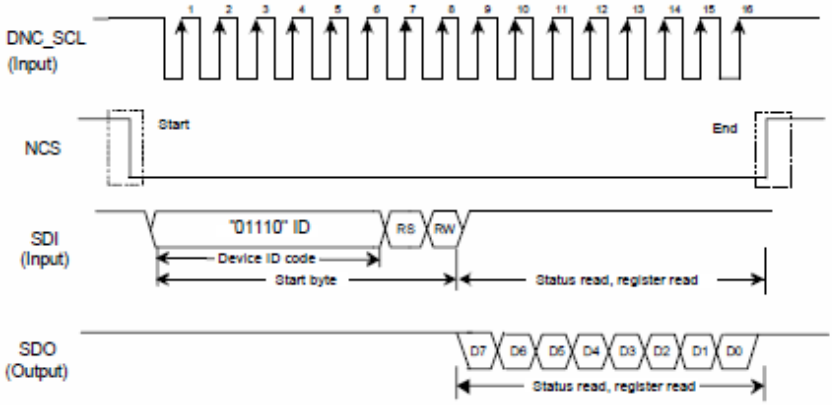
C) TransferTiming Format in Serial Bus Interface for GRAM Write (index = "22"h) , TRI(1-0) = 01



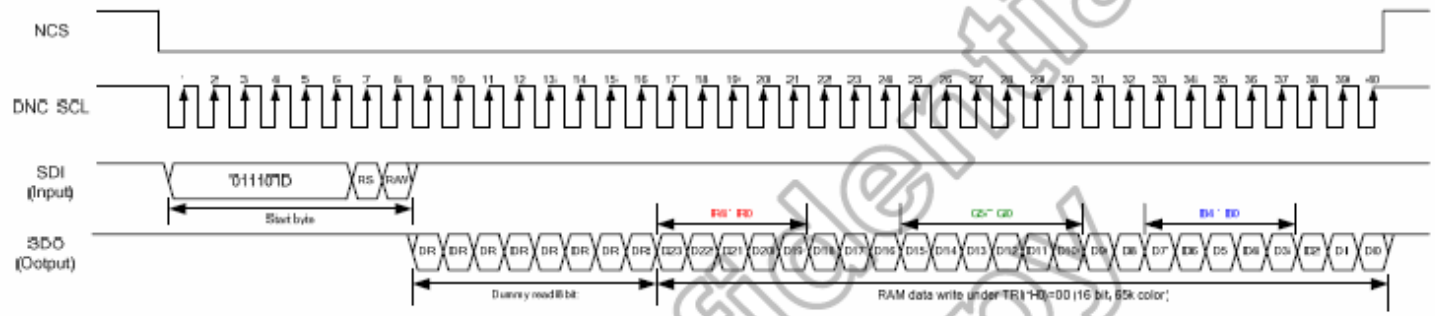
D) TransferTiming Format in Serial Bus Interface for GRAM Write (index = "22"h) , TRI(1-0) = 1x



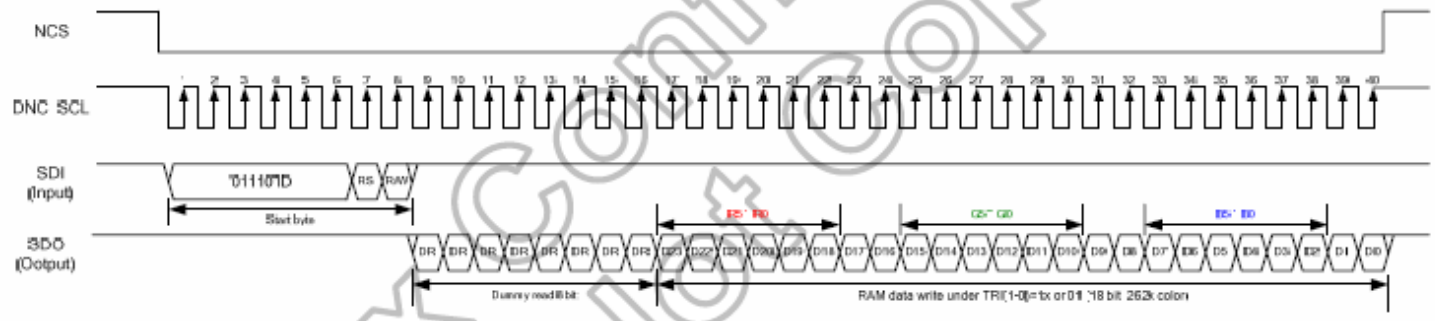
A)TransferTiming Format in Serial Bus Interface for Register Read



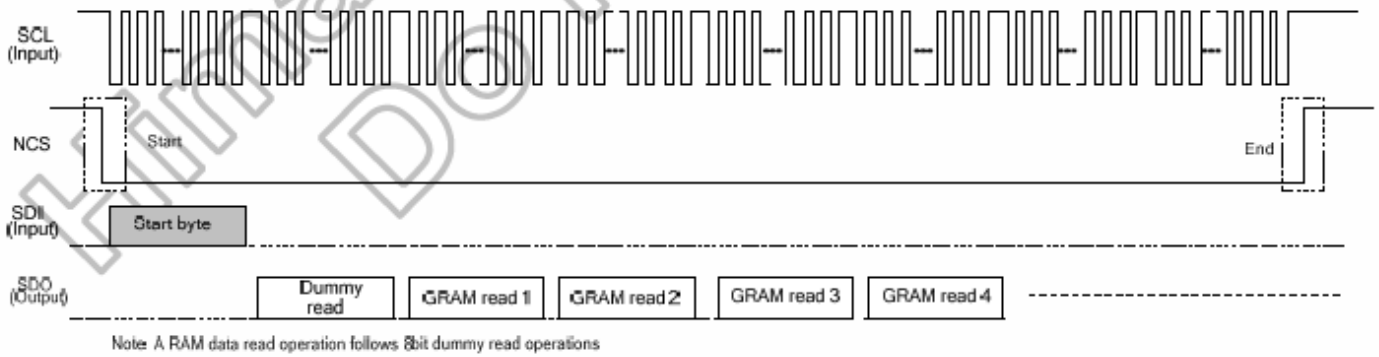
B) TransferTiming Format in Serial Bus Interface for GRAM Read (index = "22"h) , TRI(1-0) = 00



C) TransferTiming Format in Serial Bus Interface for GRAM Read (index = "22"h) , TRI(1-0) = 1x or 01



D) Timing Format of GRAM -Data Read



Note A RAM data read operation follows 8bit dummy read operations

6.4 Parallel RGB Interface Timing Characteristics

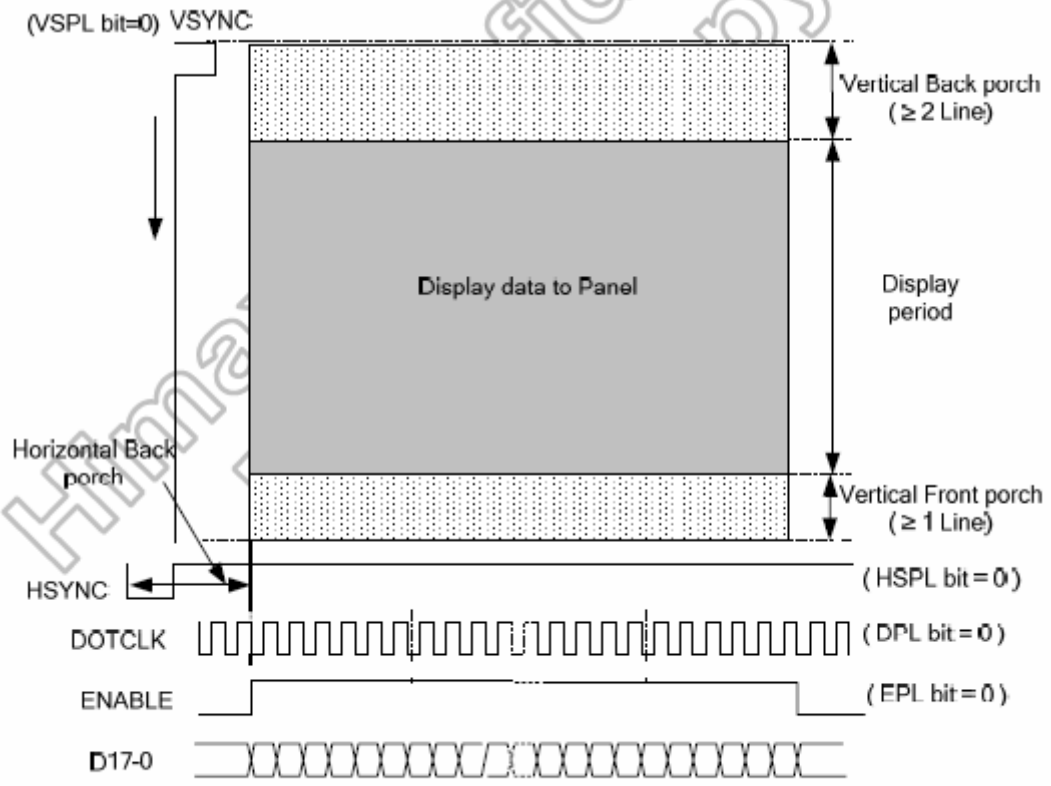


Figure 5. 17 RGB Interface Circuit Input Timing

6.4.1 16 bit/pixel color order (R 5-bit, G 6-bit, B 5-bit), 65,536 colors (CSEL(2-0) = "101")

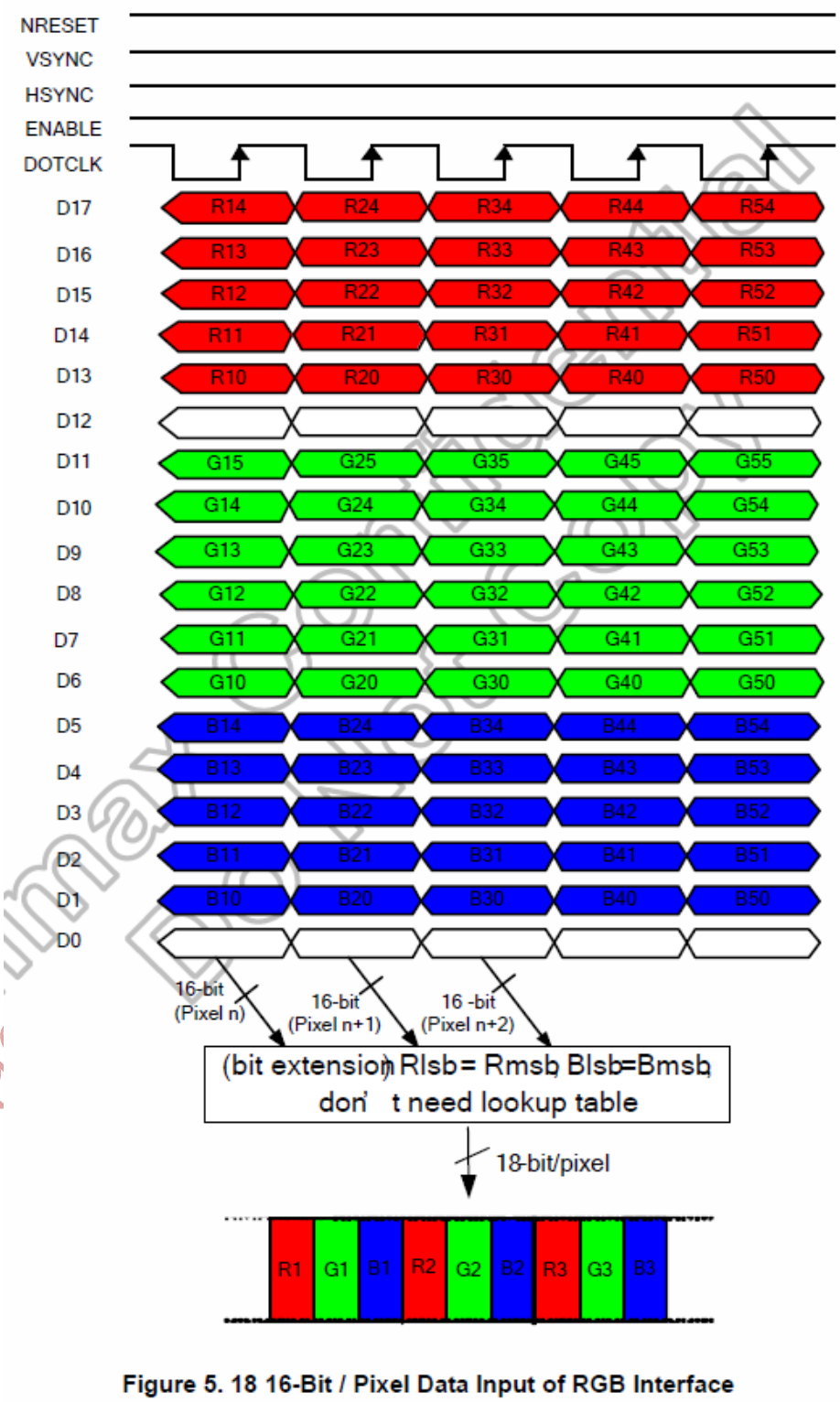


Figure 5. 18 16-Bit / Pixel Data Input of RGB Interface

6.4.2 18 bit/pixel color order (R 6-bit, G 6-bit, B 6-bit), 262,144 colors (CSEL(2-0) = “110”)

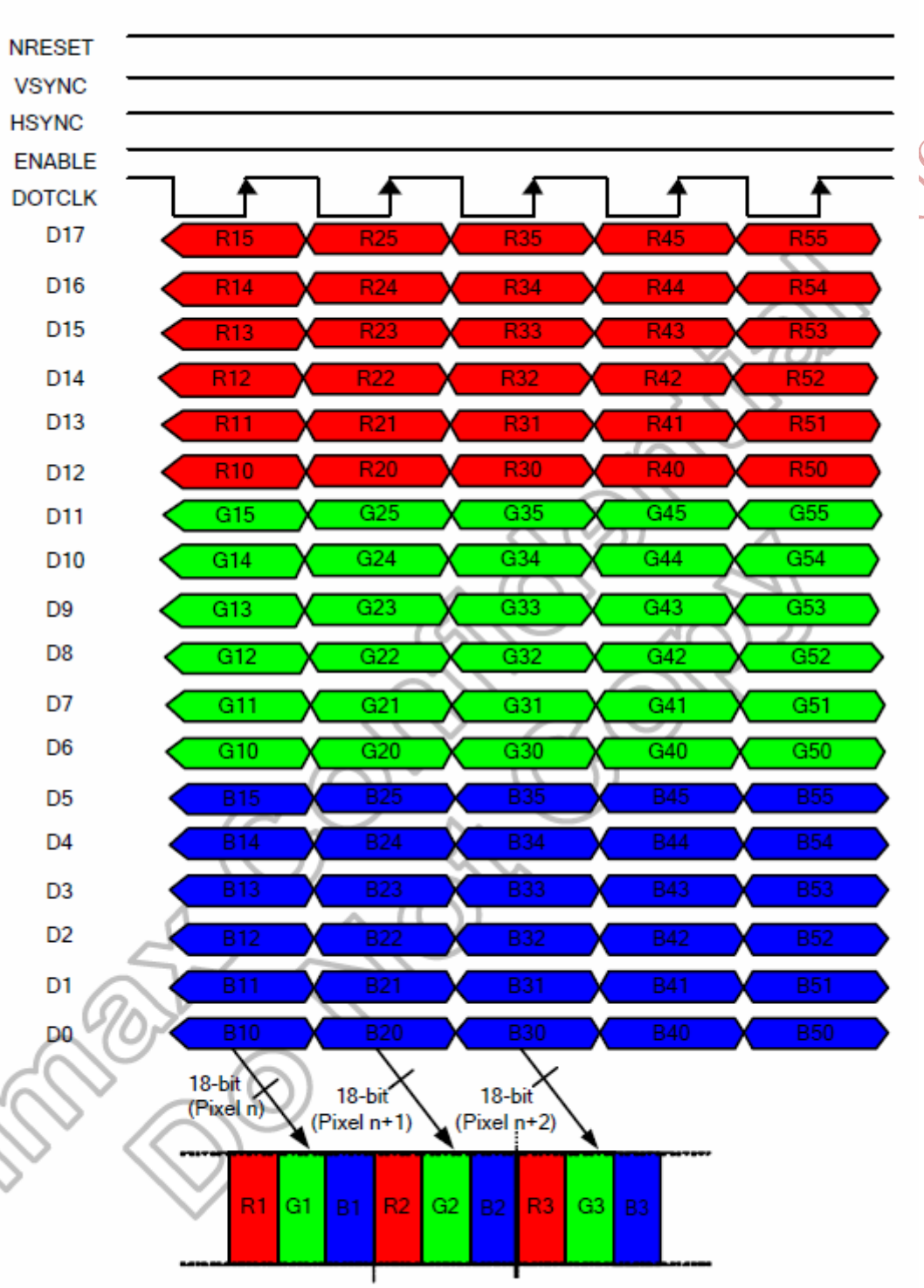


Figure 5. 19 18-Bit / Pixel Data Input of RGB Interface

7. LCD Module Out-Going Quality Level

7.1 VISUAL & FUNCTION INSPECTION STANDARD

7.1.1 Inspection conditions

Inspection performed under the following conditions is recommended.

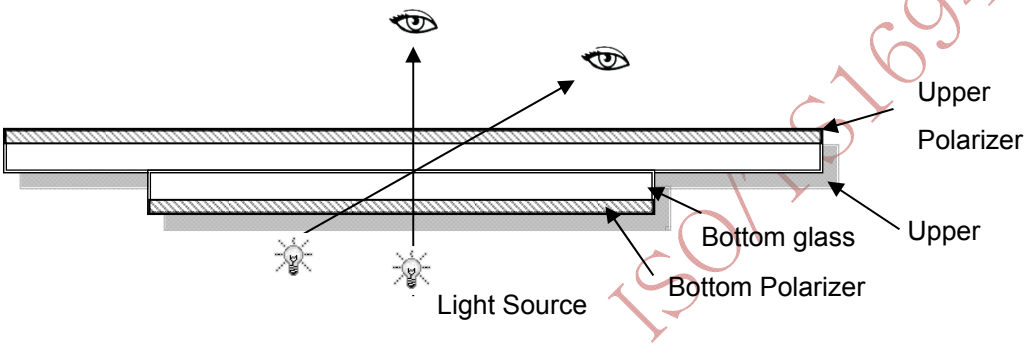
Temperature : 25±5℃

Humidity : 65%±10%RH

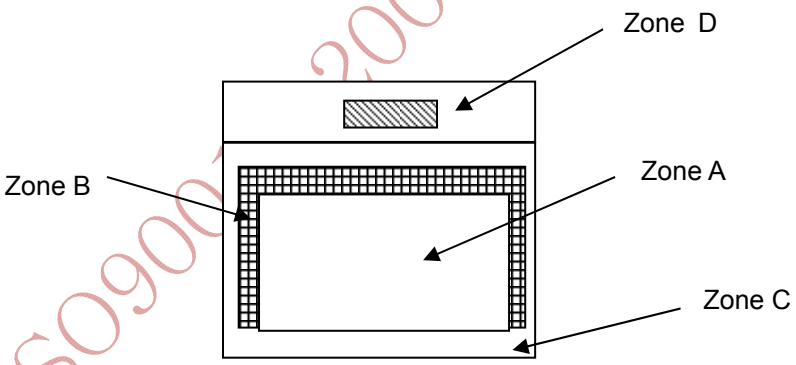
Viewing Angle : Normal viewing Angle.

Illumination: Single fluorescent lamp (300 to 700Lux)

Viewing distance:30-50cm



7.1.2 Definition



Zone A : Effective Viewing Area(Character or Digit can be seen)

Zone B : Viewing Area except Zone A

Zone C : Outside (Zone A+Zone B) which can not be seen after assembly by customer .)

Zone D : IC Bonding Area

Note:As a general rule ,visual defects in Zone C can be ignored when it doesn't effect product function or appearance after assembly by customer

7.1.3 Sampling Plan

According to GB/T 2828-2003 ; , normal inspection, Class Ⅱ

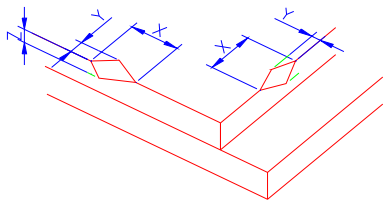
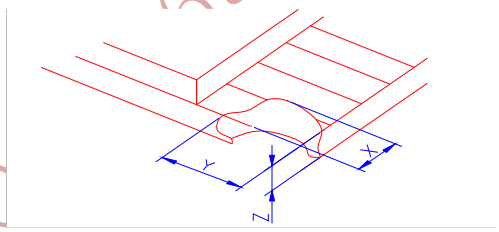
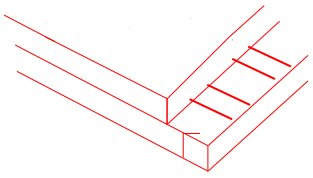
AQL:

Major defect	Minor defect
0.65	1.5

LCD: Liquid Crystal Display , TP: Touch Panel , LCM: Liquid Crystal Module

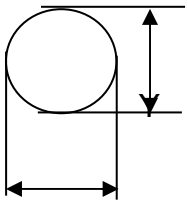
No	Items to be inspected	Criteria	Classification of defects
1	Functional defects	1) No display, Open or miss line 2) Display abnormally, Short 3) Backlight no lighting, abnormal lighting. 4) TP no function	Major
2	Missing	Missing component	
3	Outline dimension	Overall outline dimension beyond the drawing is not allowed	
4	Color tone	Color unevenness, refer to limited sample	Minor
5	Spot Line defect	Light dot、Dim spot,Polarizer Bubble ; Polarizer accidented spot.	
6	Soldering appearance	Good soldering , Peeling off is not allowed.	
7	LCD/Polarizer/TP	Black/White spot/line, scratch, crack, etc.	

7.1.4 Criteria (Visual)

<table>
<tr><th>Number</th><th>Items</th><th>Criteria(mm)</th></tr>
<tr><td rowspan="3">1.0 LCD Crack/Broken
NOTE:
X: Length
Y: Width
Z: Height
L: Length of ITO,
T: Height of LCD</td><td>(1) The edge of LCD broken</td><td> 
<table><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td>≤3.0mm</td><td><Inner border line of the seal</td><td>≤T</td></tr></table></td></tr>
<tr><td>(2)LCD corner broken</td><td> 
<table><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td>≤3.0mm</td><td>≤L</td><td>≤T</td></tr></table></td></tr>
<tr><td>(3) LCD crack</td><td> 
Crack
Not allowed</td></tr>
</table>

2.0

Spot defect



X

Φ=(X+Y)/2

① light dot（LCD/TP/Polarizer black/white spot , light dot, pinhole, dent, stain）

Zone / Size (mm)	Acceptable Qty		
	A	B	C
Φ≤0.10	Ignore		Ignore
0.10<Φ≤0.25	3(distance≧10mm)		
0.25<Φ≤0.3	2		
Φ>0.35	0		

②Dim spot（LCD/TP/Polarizer dim dot, light leakage、dark spot）

Zone / Size (mm)	Acceptable Qty		
	A	B	C
Φ≤0.1	Ignore		Ignore
0.10<Φ≤0.25	3(distance≧10mm)		
0.25<Φ≤0.3	2		
Φ>0.35	0		

③ Polarizer accidented spot

Zone / Size (mm)	Acceptable Qty		
	A	B	C
Φ≤0.2	Ignore		Ignore
0.3<Φ≤0.5	2(distance≧10mm)		
Φ>0.5	0		

④Pixel bad points（light dot，Dim dot, color dot）

Zone / Size (mm)	Acceptable Qty		
	A	B	C
Φ≤0.1	Ignore		Ignore
0.15<Φ≤0.25	2(distance≧10mm)		
Φ>0.3	0		

⑤ Polarizer Bubble

Zone / Size (mm)	Acceptable Qty		
	A	B	C
Φ≤0.2	Ignore		Ignore
0.3<Φ≤0.4	3(distance≧10mm)		
0.4<Φ≤0.5	2		
Φ>0.5	0		

<table>
<tr><td>3.0</td><td>Line defect (LCD/TP /Polarizer backlight black/white line, scratch, stain)</td><td>
<table>
<tr><td rowspan="2">Width(mm)</td><td rowspan="2">Length(mm)</td><td colspan="3">Acceptable Qty</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>Φ≤0.05</td><td>Ignore</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr>
<tr><td>0.05<W≤0.06</td><td>L≤3.0</td><td colspan="2">N≤2</td></tr>
<tr><td>0.07<W≤0.08</td><td>L≤2.0</td><td colspan="2">N≤1</td></tr>
<tr><td>0.08<W</td><td colspan="4">Define as spot defect</td></tr>
</table>
</td></tr>
<tr><td>4.0</td><td>Electronic Components SMT</td><td>Not allow missing parts，solderless connection，cold solder joint，mis match，The positive and negative polarity opposite</td></tr>
<tr><td>5.0</td><td>Display color& Brightness</td><td>1. Color：Measuring the color coordinates, The measurement standard according to the datasheet or samples.
2. Brightness：Measuring the brightness of White screen, The measurement standard according to the datasheet or Samples.</td></tr>
<tr><td>6.0</td><td>LCD Mura</td><td>By 5% ND filter invisible.</td></tr>
<tr><td>7.0</td><td>RTP Related</td><td>TP film • bubble/ accidented spot</td><td>
<table>
<tr><td rowspan="2">Size Φ(mm)</td><td colspan="3">Acceptable Qty</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>Φ≤0.1</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr>
<tr><td>0.1<Φ≤0.2</td><td colspan="2">3（distance≧10mm）</td></tr>
<tr><td>0.25<Φ≤0.3</td><td colspan="2">2</td></tr>
<tr><td>Φ>0.35</td><td colspan="2">0</td></tr>
</table>
</td></tr>
</table>

TP film scratch

Width(mm)	Length(mm)	Acceptable Qty		
		A	B	C
Φ≤0.05	Ignore	Ignore		Ignore
0.05<W≤0.06	L≤3.0	N≤2		
0.07<W≤0.08	L≤2.0	N≤1		
0.08<W	Define as spot defect			

Assembly deflection

beyond the edge of backlight ≤0.2mm

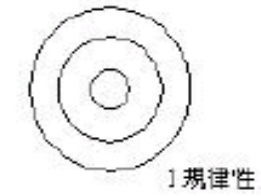
Bulge (undulation included)

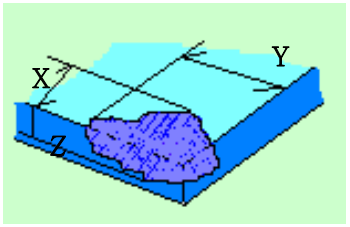
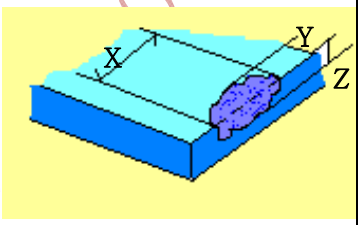
The ITO film plumped below 0.40mm, it's ok.

Newton Ring

Newton Ring area>1/3 TP area NG

Newton Ring area≤1/3 TP area OK



		TP corner broken X：length Y：width Z：height	X: X≤3mm; Y: Y≤3mm; Z: Z<COVER thickness *Circuitry broken is not allowed.	
		TP edge broken X：length Y：width Z：height	X: X≤4mm; Y: Y≤2mm; Z: Z<COVER thickness * Circuitry broken is not allowed.	

Criteria (functional items)

Number	Items	Criteria (mm)
1	No display	Not allowed
2	Missing segment	Not allowed
3	Short	Not allowed
4	Backlight no lighting	Not allowed
5	TP no function	Not allowed

8. Reliability Test Result

Item	Condition	Inspection after test
High Temperature Operating	85℃,96H	Inspection after 2~4hours storage at room temperature, the sample shall be free from defects: 1.Air bubble in the LCD; 2.Non-display; 3.Missing segments/line; 4.Glass crack; 5.Current IDD is twice higher than initial value.
Low Temperature Operating	-30℃, 96HR	
High Temperature Storage	90℃, 96HR	
Low Temperature Storage	-40℃, 96HR	
High Temperature & High Humidity Operating	+60℃, 90% RH ,96 hours.	
Thermal Shock (Non-operation)	-40℃,30 min ↔ 90℃,30 min, Change time:5min 20CYC.	
ESD test	C=150pF, R=330,5points/panel Air:±8KV, 5times; Contact:±6KV, 5 times; (Environment: 15℃~35℃, 30%~60%).	
Vibration (Non-operation)	Frequency range:10~55Hz, Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X.Y.Z. (6 hours for total) (Package condition).	
Box Drop Test	1 Corner 3 Edges 6 faces,80㎝(MEDIUM BOX)	

Remark:

1.The test samples should be applied to only one test item.

2.Sample size for each test item is 5~10pcs.

3.For Damp Proof Test, Pure water(Resistance＞10MΩ) should be used.

4.In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judged as a good part.

5.Failure Judgment Criterion: Basic Specification, Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.

9. Cautions and Handling Precautions

9.1 Handling and Operating the Module

(1) When the module is assembled, it should be attached to the system firmly.
Do not warp or twist the module during assembly work.
(2) Protect the module from physical shock or any force. In addition to damage, this may cause improper operation or damage to the module and back-light unit.
(3) Note that polarizer is very fragile and could be easily damaged. Do not press or scratch the surface.
(4) Do not allow drops of water or chemicals to remain on the display surface.
If you have 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 ketene 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 clothes, it must be washed away thoroughly with soap.
(8) Protect the module from static; it may cause damage to the CMOS ICs.
(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 electrostatic charge can be minimized.
(12) Pins of I/F connector shall not be touched directly with bare hands.
(13) Do not connect, disconnect the module in the “Power ON” condition.
(14) Power supply should always be turned on/off by the item 6.1 Power On Sequence &6.2 Power Off Sequence

9.2 Storage and Transportation.

(1) Do not leave the panel in high temperature, and high humidity for a long time.
It is highly recommended to store the module with temperature from 0 to 35 ℃ and relative humidity of less than 70%
(2) Do not store the TFT-LCD module in direct sunlight.
(3) The module shall be stored in a dark place. When storing the modules for a long time, be sure to adopt effective measures for protecting the modules from strong ultraviolet radiation, sunlight, or fluorescent light.
(4) It is recommended that the modules should be stored under a condition where no condensation is allowed. Formation of dewdrops may cause an abnormal operation or a failure of the module.
In particular, the greatest possible care should be taken to prevent any module from being operated where condensation has occurred inside.
(5) This panel has its circuitry FPC on the bottom side and should be handled carefully in order not to be stressed.

10. Packing

----TBD----------